2UCD074000E001_H

PCS100 AVC-40

Active Voltage Conditioner

User Manual

ABOUT THIS DOCUMENT

Introduction

Voltage sags, voltage surges, phase imbalance and flicker are common events that often cause electric and electronic equipment to malfunction. When such events occur in critical control operations, they can cause the complete shutdown of a facility.
The PCS100 AVC-40 is an Active Voltage Conditioner designed to solve these problems. It is a high-performance power electronic system that responds instantly to power quality events and provides online regulation of voltage.
Using state-of-the-art power electronics technology the correction is step-less which minimizes disturbances and ensures a regulated premium power supply for important loads.
For a comprehensive overview of publications available for the PCS100 AVC-40, refer to the rear inside cover of this publication.
Web links and QR code are also included.

The Company

We are an established world force in the design and manufacturing of power electronics and power protection equipment.
As part of ABB, a world leader in electrical technology, we offer customers application expertise, service, and support worldwide.
We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.
The quality, accuracy and performance of the Company's products result from over 140 years' experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

For More Information

Further publications for the PCS100 AVC-40 are available to download for free from
http://new.abb.com/ups/power-and-voltage-conditioners/voltage-conditioners/pcs100-avc-40

Document Information

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This Document

This manual contains information regarding:

- the general functions of the PCS100 AVC-40
- the component enclosures making up the PCS100 AVC-40
- the user interface and control and adjustments of the PCS100 AVC-40

Refer to document 2UCD074000E013 for 150-300 kVA IEC AVC-40 and 225-300 KVA UL AVC-40

Usage

This manual should be used during operation and adjustment of the PCS100 AVC-40

Who Should Read This Manual?

This manual is intended for:

- maintenance personnel
- Operators

Prerequisites

An installation/repair/operator personnel working with the PCS100 AVC-40 must:

- be trained by ABB and have electrical operational and safety knowledge
- have sufficient training to operate in an accidentally touch safe service environment.

NOTE – See section 18 of this document for a list of related documents which will be required for Installation, Commissioning, and Servicing purposes.

Software Revision

This manual applies to PCS100 AVC-40 systems with software revision R2J4.

https://new.abb.com/ups/

SAFETY
Safety Instructions

AE	تحذير :جهد كهربائي خطر ! .راجع تعليمات التشغيل افصل الكهرباء وقم بتأمينها قبل العمل في هذا الجهاز . تنبيه !يجب عدم التركيب إلا من خلال شخص على دراية بمجال التقنية الكهربائية
BG	Предупреждение: Опасно напрежение! Вижте инструкциите за работа. Изключете и блокирайте захранването преди да работите с устройството. Внимание! Да се монтира само от експерт електротехник.
CZ	Varování: Nebezpečné napětí! Viz návod k obsluze. Před zahájením prací na tomto zařízení odpojte a uzamkněte napájení. Pozor! Toto zařízení smí instalovat pouze osoba s elektrotechnickou odborností.
DK	Advarsel: Farlig elektrisk spænding! Se betjeningsvejledningen. Frakobl enheden, og afbryd strømforsyningen, før du arbejder med denne enhed. Giv agt! Installation må kun foretages af personer med elektroteknisk ekspertise.
DE	Warnung: Gefährliche Spannung! Siehe Bedienungsanleitung. Vor dem Arbeiten Gerät ausschalten und von der Spannungsversorgung trennen. Achtung! Installation nur durch elektrotechnische Fachkraft.
GR	Προειδοποίηση: Επικίνδυνη τάση! Ανατρέξτε στις οδηγίες λειτουργίας. Αποσυνδέστε και απομονώστε την παροχή ισχύος προτού ξε κινήσετε τις εργασίες σε αυτήν τη συσκευή. Προσοχή! Η εγκατάσταση πρέπει να γίνεται μόνο από αδειούχο ηλεκτρολόγο εγκαταστάτη.
EN	Warning: Hazardous voltage! Refer to installation instructions. Disconnect and lock out power before working on this device. Attention! Installation by person with electrotechnical expertise only.
ES	Advertencia: ¡Tensión peligrosa! Consulte las instrucciones de funcionamiento. Antes de trabajar con este dispositivo, desconecte y bloquee la corriente. ¡Atención! La instalación debe ser realizada únicamente por un técnico electricista.
EE	Hoiatus: Elektrilöögi oht! Lisateavet vaadake kasutusjuhendist. Enne selle seadmega töötamist ühendage lahti ja lukustage toide. Tähelepanu! Seadet tohib paigaldada ainult elektrotehnilise kogemusega isik.
FI	Varoitus: Vaarallinen jännite! Katso käyttöohje. Katkaise virta ja estä virran kytkeminen lukituksella ennen töiden aloittamista. Huomio! Asennuksen saa suorittaa vain henkilö, jolla on kokemusta sähkötekniikasta.
FR	Avertissement: Tension dangereuse! Consultez les consignes d'utilisation. Débranchez et verrouillez l'alimentation électrique avant d'entreprendre des travaux sur cet appareil. Attention! L'installation doit être effectuée uniquement par une personne ayant une expertise en électrotechnique.
HR	Upozorenje: Opasan napon! Pogledajte upute za uporabu. Odspojite i isključite struju prije rada na ovom uređaju. Pažnja! Ugradnja je dopuštena samo osobama stručnim u području elektrotehnike.
HU	Figyelmeztetés: Veszélyes feszültség! Lásd a használati utasítást. Válassza le és zárja ki az áramellátást, mielőtt a berendezésen dolgozni kezd. Figyelem! Az üzembe helyezést csak elektrotechnikai szakértelemmel rendelkező személy végezheti el.
IT	Attenzione: Tensione pericolosa! Fare riferimento alle istruzioni per l'uso. Prima di intervenire su questo dispositivo, scollegare e isolare tutte le fonti di alimentazione. Attenzione! L'installazione deve essere eseguita esclusivamente da un installatore qualificato.
LT	Įspėjimas: Pavojinga įtampa! Žr. naudojimo instrukcijas. Atjunkite ir laikinai užblokuokite maitinimą prieš dirbdami su šiuo įrenginiu. Dėmesio! Įrengti gali tik asmuo, turintis elektrotechniko patirties.
LV	Brīdinājums: Bīstams spriegums! Skatiet darba norādījumus. Pirms sākat darbu ar šo ierīci, atvienojiet un bloķējiet strāvas padevi. Uzmanību! Uzstādīšanu drīkst veikt tikai persona ar zināšanām par elektrotehniku.
NL	Waarschuwing: Gevaarlijke spanning! Raadpleeg de bedieningsinstructies. Koppel dit apparaat los van de stroomvoorziening voordat u werkzaamheden uitvoert. Let op! Installatie mag alleen worden uitgevoerd door een monteur met elektrotechnische expertise.
NO	Advarsel: Farlig spenning! Se i bruksanvisningen. Koble fra og steng av strømmen før du arbeider på denne enheten. Forsiktig! Montering skal kun utføres av kvalifiserte personer med elektrokompetanse.
PL	Ostrzeżenie: Niebezpieczne napięcie! Patrz: instrukcja obsługi. Przed rozpoczęciem wykonywania pracy z tym urządzeniem odłącz i zablokuj zasilanie. Uwaga! Montaż może wykonywać wyłącznie osoba posiadająca doświadczenie elektrotechniczne.
PT	Aviso: Tensão perigosa! Consulte as instruções de operação. Desconecte e desligue a energia elétrica antes de trabalhar nesse dispositivo. Atenção! A instalação deve ser feita apenas por uma pessoa com especialidade eletrotécnica.
RO	Avertisment: Tensiune electrică periculoasă! Consultați instrucțiunile de utilizare. Deconectați și închideți sursa de energie înainte de a lucra cu acest dispozitiv. Atenție! Instalare
RU	Внимание: Опасное электрическое напряжение! Обратитесь к инструкциям по эксплуатации. Отключите питание и обесточьте устройство перед началом работ. Внимание! Установка должна выполняться только специалистом по электротехническим работам.
SK	Výstraha: Nebezpečné napätie! Pozrite si návod na použitie. Pred začatím prác na tomto zariadení odpojte a zablokujte napájanie. Pozor! Inštaláciu smie vykonávať len osoba s odbornými znalosťami v oblasti elektrotechniky.
SL	Opozorilo: Nevarna napetost! Glejte navodila za uporabo. Pred delom na tej napravi izklopite in zaklenite električno napajanje. Pozor! Namestitev sme izvesti samo elektrotehnični strokovnjak.
SE	Varning: Livsfarlig spänning! Se i bruksanvisningen. Frånkoppla och blockera anläggning eller en anläggningsdel innan arbeite utförs. Obs! Får endast installeras av behörig elektriker.
TR	Uyarı: Tehlikeli gerilim! Çalışma talimatlarına bakın. Bu cihaz üzerinde çalışmadan önce elektriği kesin ve kilitleyin. Dikkat! Yalnızca elektroteknik uzmanlığa sahip kişiler tarafından kurulabilir.
CN	警告：高压危险! 请参见操作手册 操作本设备前请断开并锁定电源。 注意！安装仅限专业电工人员。

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Safety Notices

This manual contains important information regarding the operation of the ABB's PCS100 AVC-40. This manual provides technical and operational guidance for operators and maintenance personnel. The following safety instructions are to be observed.

This manual contains important information regarding the operation of the ABB PCS100 AVC-40. This manual provides technical and operational guidance for operators. The following safety instructions are to be observed.

This manual does not provide sufficient information for safe service of the PCS100 AVC-40. For such service information refer to appropriate manual.

Please pay due regard to safety as the PCS100 AVC-40s are high energy devices and require strict precautions to be taken.

CAUTION – Trained Operators
All operations on the PCS100 AVC-40 must only be carried out by a trained operator familiar with the contents of this manual. Hazardous conditions could arise from incorrect adjustment.

DANGER – Hazardous Voltages
An operator must not open doors or panels marked as containing hazardous voltages. Many parts of this product, including printed circuit boards operate at lethal voltages. DO NOT TOUCH components or connections that have voltage present

DANGER – Hazardous Voltages
Ensure power to the product is isolated and locked off before attempting any work on it.

DANGER – Arc Flash
Shorted terminals can cause arc flash resulting in severe burns, severe eye injury or blindness. Use insulated tools and do not short any terminals.

DANGER – Stored Charge
Stored charge is present after the device is switched off.

DANGER – Protective Covers
Normal operation of this product requires any protective covers to be in place and doors secured closed.

DANGER – Personal Protection Equipment
Ensure safety glasses are worn while working if any part of the unit could be energized.
Ensure appropriate safety footwear is worn if inserting or removing modules or components from the product.

Contents

1 OVERVIEW

The ABB PCS100 AVC-40 is an inverter-based system that protects sensitive industrial and commercial loads from voltage disturbances. Providing fast, accurate voltage sag and surge correction as well as continuous voltage regulation and load voltage compensation, the PCS100 AVC-40 has been optimally designed to provide downstream equipment immunity from power quality events on the AC supply network.

1.1. Cause of Voltage Sags

Voltage sags on the AC supply network can be caused by large load changes, capacitor bank switching and motor starting. They may also be caused by faulty equipment such as electrical connectors, tap changers and transformers. However, the most common cause of voltage sags is short circuit faults in the distribution and transmission networks or at a neighboring load. Short circuit faults can be the result of acts of nature such as lightning, storms or trees growing into overhead lines, or third-party actions on the network such as vehicle accidents, construction work or animals shorting lines.

1.2. Nature of Voltage Sags

The voltage sag seen by the customer is dependent on the location of the fault and the impedances between the fault location and the customer location. The duration of the voltage sag is determined by the duration of the fault, or the reclosing practices operated by the utility. The magnitude of the voltage sag is governed by the ratio of the impedance between the customer location and fault location compared to the total supply impedance (from the fault location).

Customers located closer to the fault will experience deeper sag and possibly an interruption while the breaker or fuse operates. The vast majority of customers connected further away from the fault will experience more shallow sag. The sag on the three-phase network will in most cases be transformed by the distribution transformer at the input to the customer's factory, and therefore the voltage sag actually seen by the customer will be quite different from that measured on the AC supply network. For example, single-phase-to-ground sag on the utility side of a delta-star distribution transformer will be transformed to a phase-to-phase sag on the load side. Understanding this is important because monitoring of the utility network does not necessarily give a clear picture of the voltage sag that the equipment is experiencing. Often monitoring at the customer site is required to determine this.

2 FUNCTIONAL DESCRIPTION

2.1 How it works

The PCS100 AVC-40 is a three-phase low voltage product which corrects voltage sags, phase angle errors, imbalance, and surges, while providing continuous voltage regulation. The PCS100 AVC-40 requires no energy storage as it draws the additional current required to make up the correction voltage from the utility supply.

Figure 2-1: PCS100 AVC-40 concept.

2.2 Correction Capabilities

The PCS100 AVC-40 is defined by its maximum three phase correction capability of 40% of its rated voltage. PCS100 AVC-40 full correction capability is 100% correction of three-phase supply sags with 60% remaining voltage.

Detailed correction capabilities are shown in the following table.

Utility Supply Problem	Input	Output	Correction Time
Three-phase utility sags correction from	60% remaining supply voltage	100%	30 seconds
	50% remaining supply voltage	90%	10 seconds
	40% remaining supply voltage	70%	600 milliseconds

Utility Supply Problem	Input	Output	Correction Time
Single-phase utility sags correction from	40% remaining voltage	100%	30 seconds
	0% remaining voltage	57%	600 milliseconds
Single-phase utility swells correction from	115% voltage	100%	continuous
Three-phase utility undervoltage to 90% of the nominal supply voltage		100%	continuous
Three-phase utility overvoltage up to 110% of the nominal supply voltage		100%	continuous
Correction of phase angle errors created by faults in the supply system		Yes	
Correction of voltage imbalance from utility supply		Yes	
Attenuation of flicker voltages in the utility supply		Yes	

Table 2-1: PCS100 AVC-40 correction capabilities

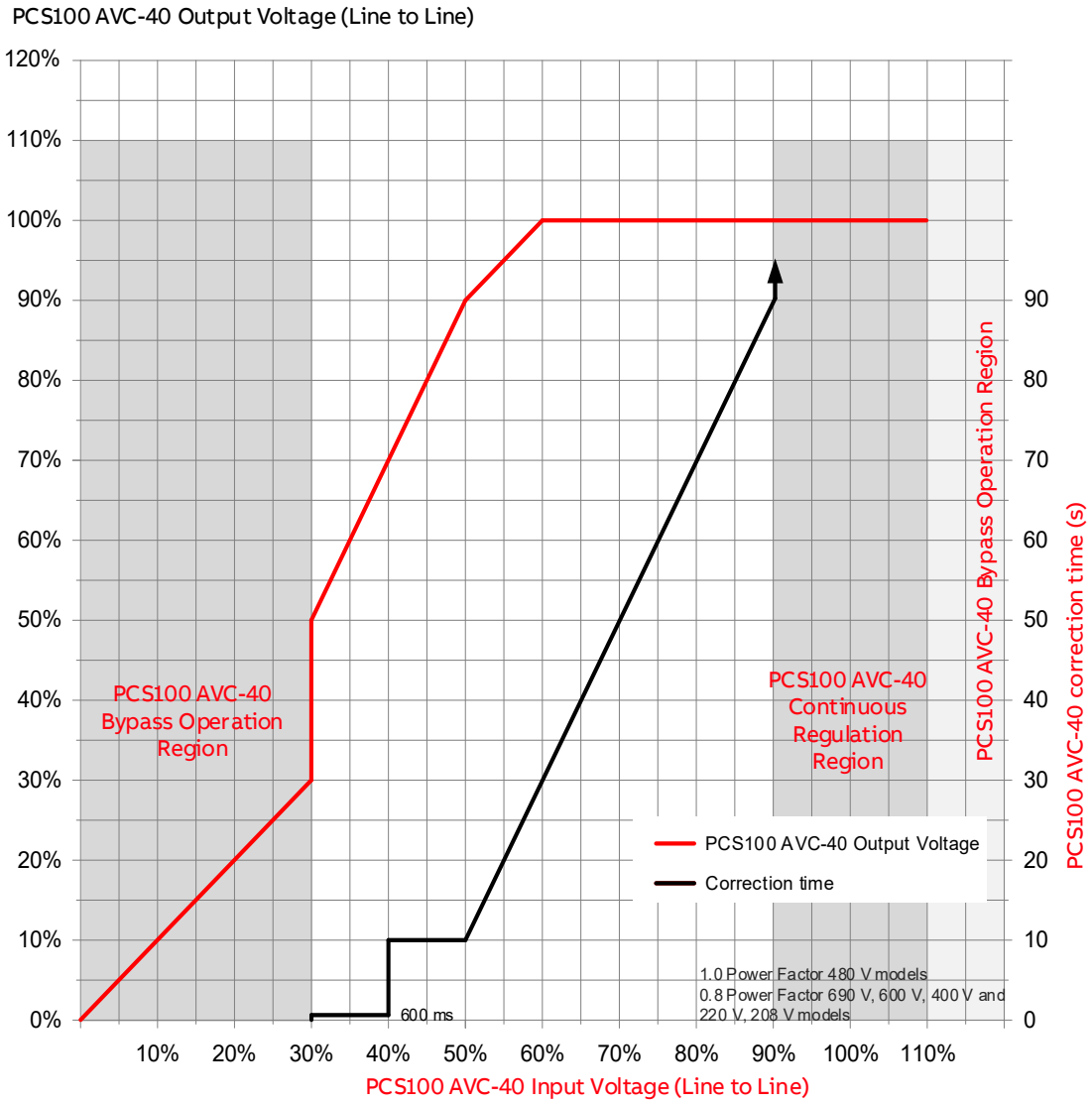
The PCS100 AVC-40 thus provides the user with a high-quality supply, protecting loads from the majority of common voltage disturbances.

2.3 PCS100 AVC-40 Performance Curves

This section explains PCS100 AVC-40 general performance based on relationship between the input voltage and corrected output voltage.

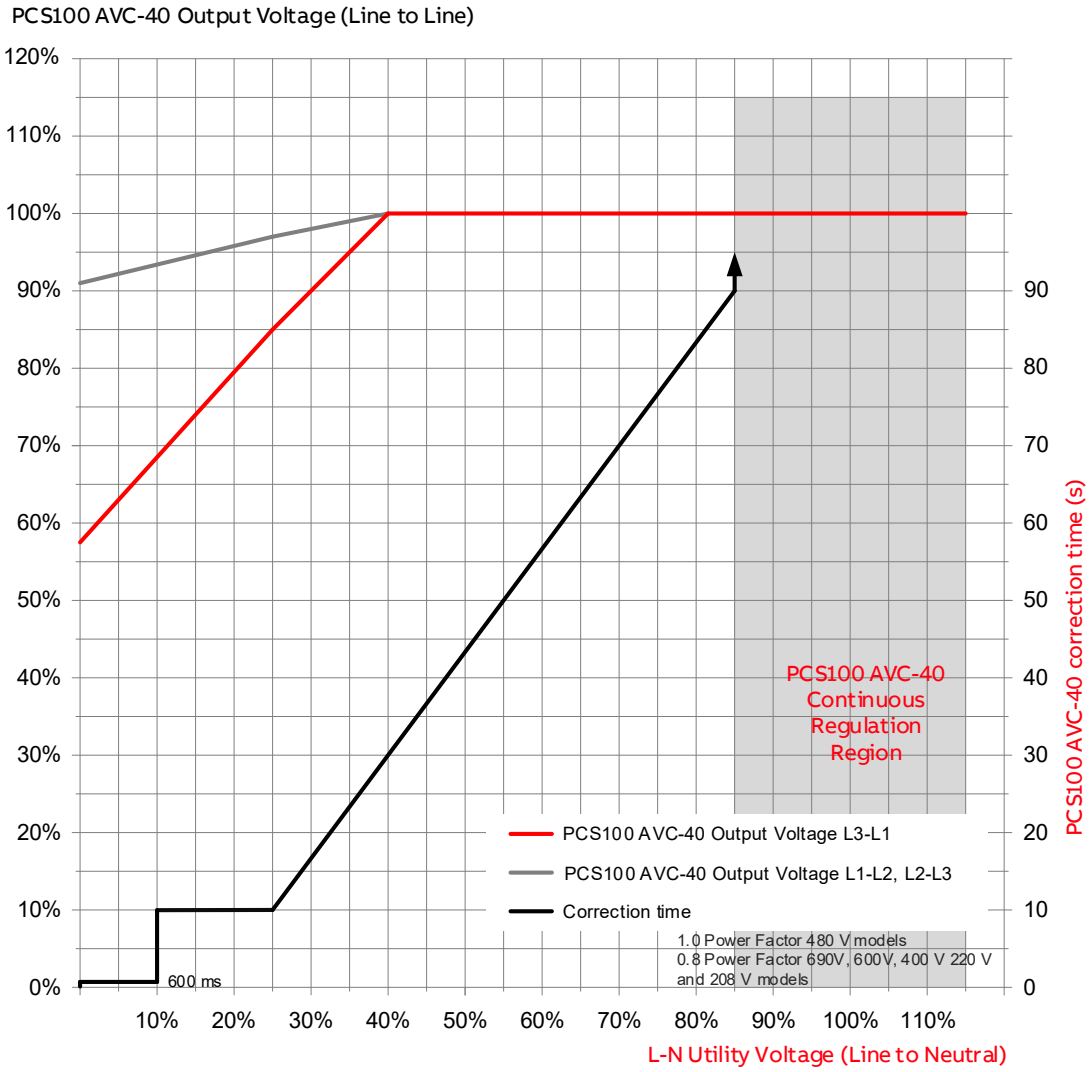
Three Phase Balanced Events

The performance curves below apply to three phase balanced supply voltage disturbances upstream of the PCS100 AVC-40.



Single-Line-To-Ground Events

The performance curves below apply to single-line-to-ground supply voltage disturbances upstream of the Dyn11 distribution transformer upstream of PCS100 AVC-40.



2.4 How to Use Performance Curves

1. Determine input voltage level on the horizontal axis
2. Read corrected output voltage level on the blue curve with values on left vertical axis
3. Read minimum correction time for defined input voltage level on the green curve with values on right vertical axis

2.4.1 Example

480 V unit with 55% remaining supply voltage on all 3 phases of the input.
Based on performance curves above:

– PCS100 AVC-40 corrected output voltage level is 95% for at least 20 seconds.

2.4.2 Additional Performance Curves

For more information on PCS100 AVC-40 performance curves refer to document 2UCD070000E020 PCS100 AVC Detailed Performance Curves.

2.5 Single Line Diagram

The PCS100 AVC-40 consists of a voltage source inverter driving a series connected Injection Transformer (two Injection Transformers are used for larger systems) which is installed between the supply and the load. It measures the incoming supply voltage and provides almost instantaneous correction for any disturbances.
The PCS100 AVC-40 incorporates a bypass system which is used in the event of a fault situation outside of the PCS100 AVC-40 specifications. Should the inverter become overloaded the bypass system shunts the Injection Transformer, relieving the load from the inverter. The voltage delivered to the load under bypass is therefore equal to the utility voltage.

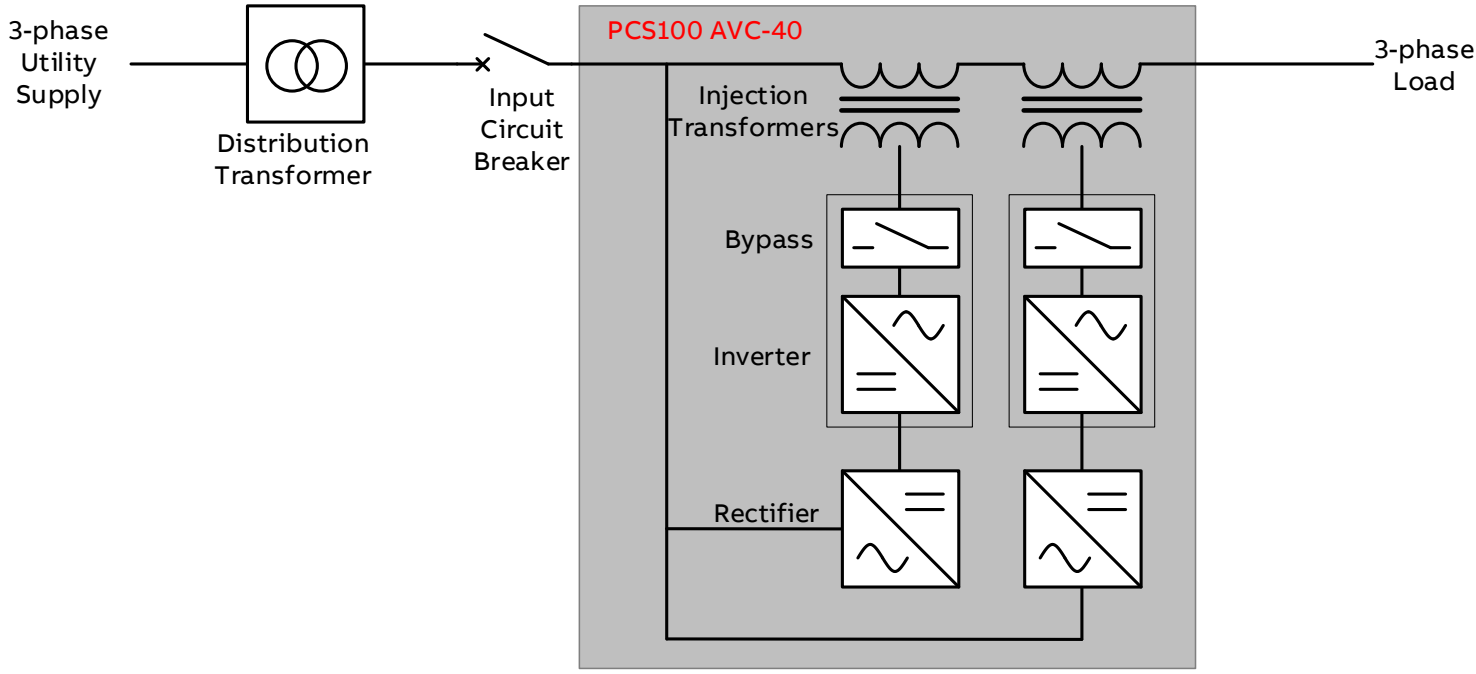


Figure 2-2: PCS100 AVC-40 single line diagram (for large systems)

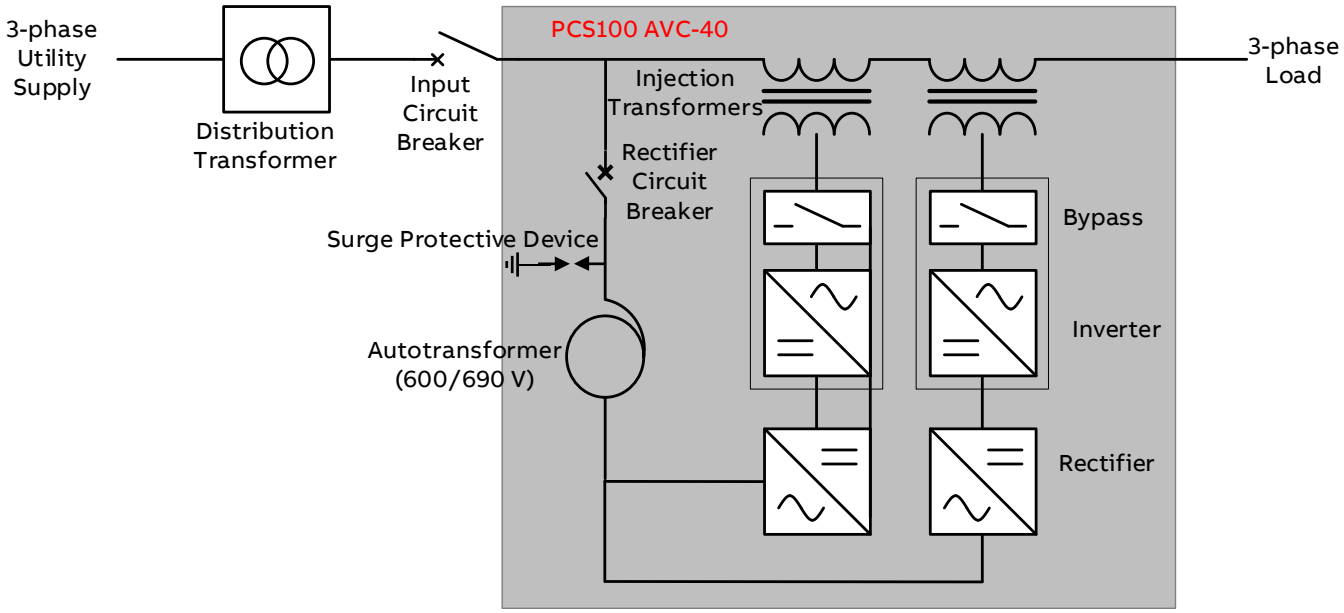


Figure 2-3: PCS100 AVC-40 600 /690 V single line diagram (for 3.6 MVA)

2.6 Operation Details

The following diagrams show how the PCS100 AVC-40 behaves when a utility disturbance occurs, and what happens if the internal bypass operates.

2.6.1 Utility Disturbance Occurs

When the utility voltage deviates from nominal or the set point due to a power quality event, the inverter will inject a correction voltage via the Injection Transformer. The correction voltage level is based on the disturbance level and the energy needed for correction is sourced from the utility via the PCS100 AVC-40 rectifier.

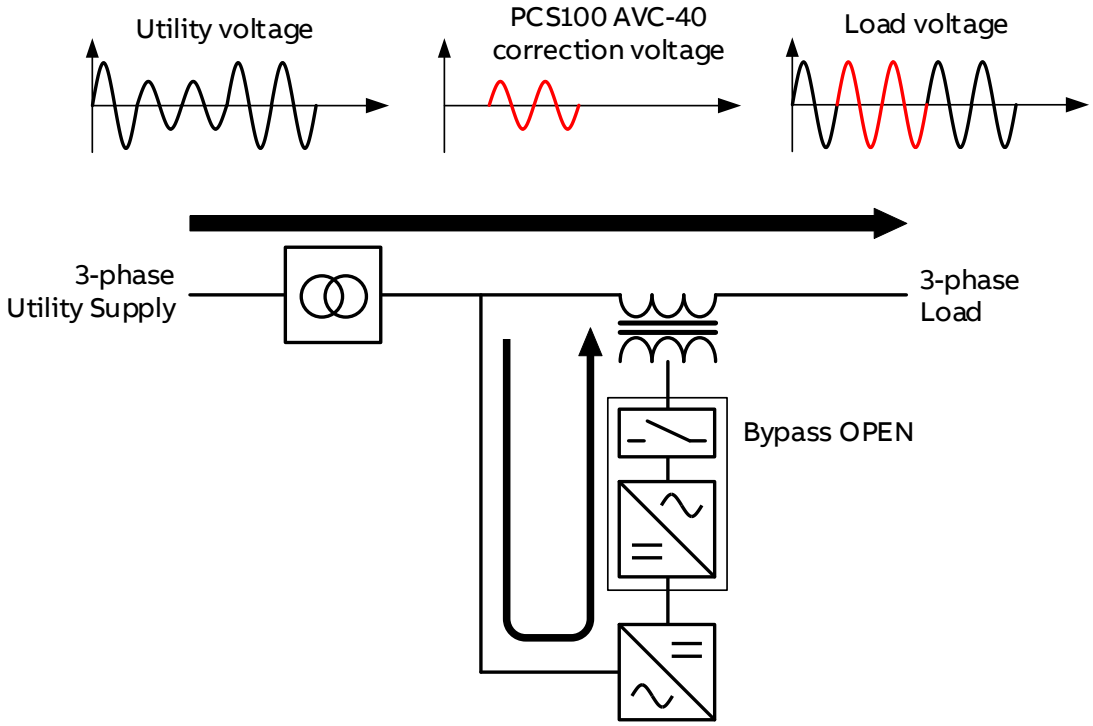


Figure 2-4: PCS100 AVC-40 energy flow in case of utility voltage below the nominal level

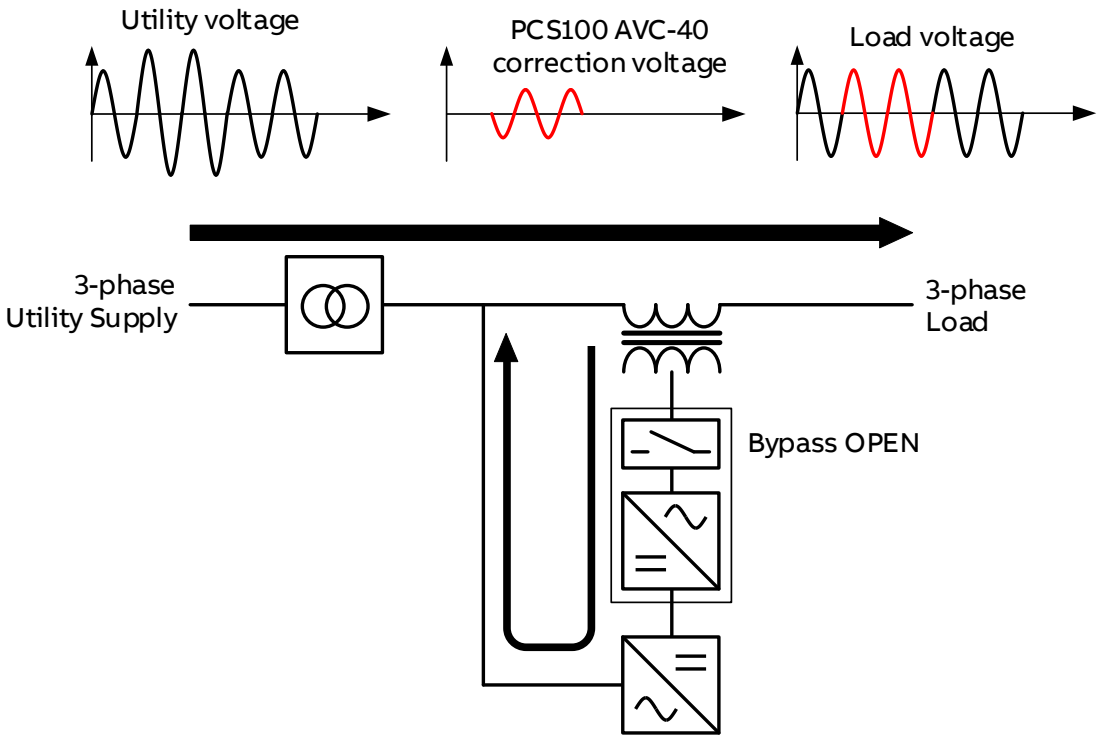


Figure 2-5: PCS100 AVC-40 energy flow in case of utility voltage above the nominal level

2.6.2 Utility Voltage within Continuous Regulation Range

When the utility voltage is within continuous regulation range (±10%), i.e., typical utility supply conditions without sags or surges, the PCS100 AVC-40 is only adding small corrections for utility voltage unbalance or load induced voltage variations.

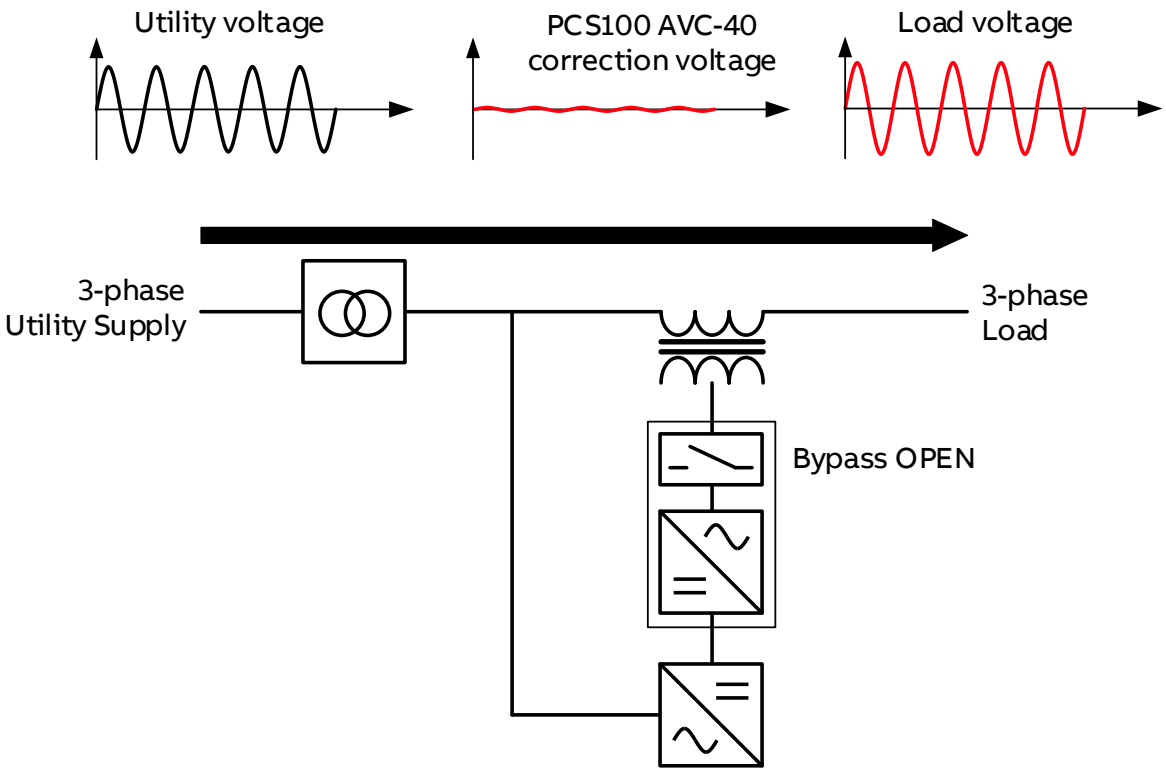


Figure 2-6: PCS100 AVC-40 energy flow in case of utility supply equal to nominal level

2.6.3 Internal Bypass Operation

In the case of an overload or internal fault condition the internal bypass circuit will shunt the inverter side of the Injection Transformer, bypassing the inverter and effectively providing a direct connection from the utility supply to the output, without interruption to the load.

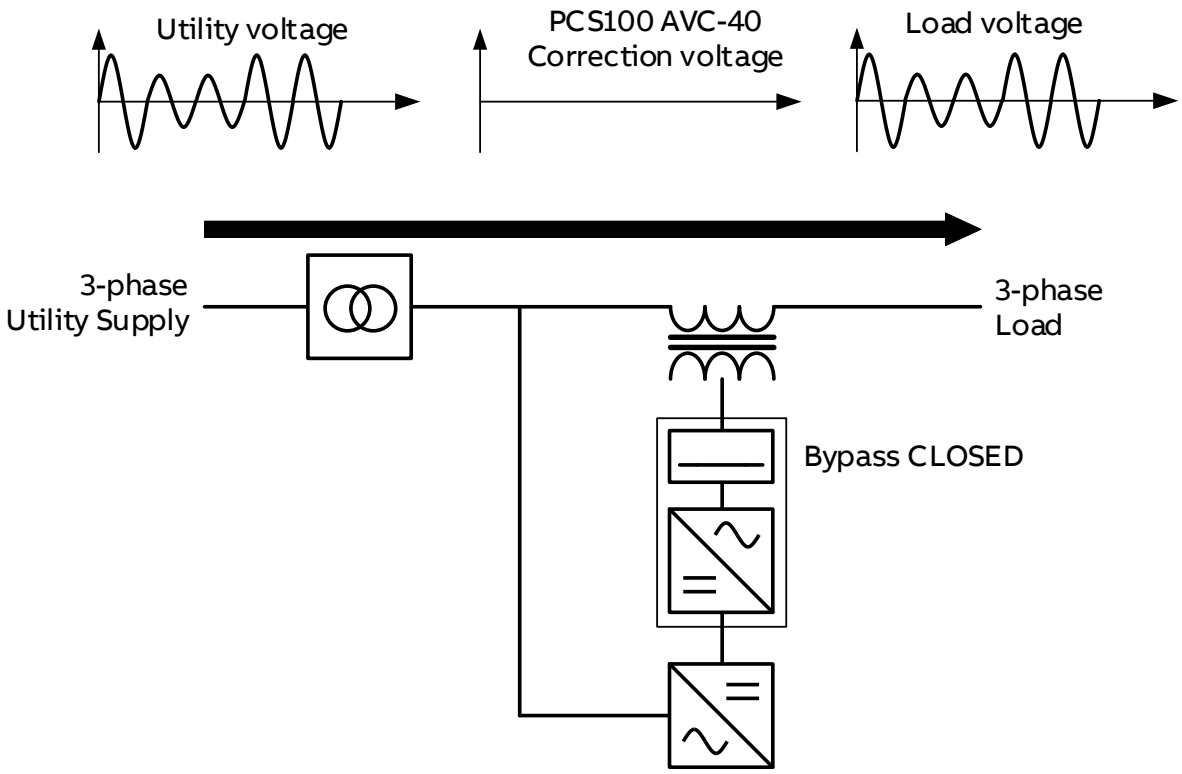


Figure 2-7: PCS100 AVC-40 energy flow in case of bypass operation.

3 MODEL DEFINITION

3.1 Type Code

The PCS100 AVC-40 type code is given in the product tables. The type code is a unique code for the specific PCS100 AVC-40 model and specifies all the components that are used to construct the model. From the base code given in the product tables options can be added to the type code. These options are called plus (+) codes.
The following diagram outlines the structure of the type code:

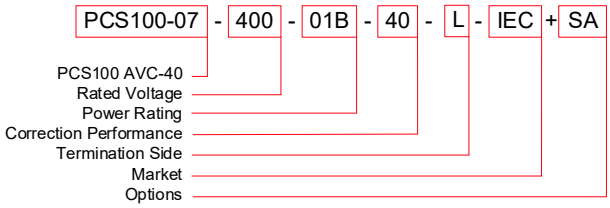


Figure 3-1: PCS100 AVC-40 type code.

3.1.1 Rated Voltage

This is the rated voltage of the PCS100 AVC-40.
Options are 690 V, 600 V, 480 V, 400 V and 220 V. Other operating voltages (i.e., 380 V) are achieved by software settings and setting of an auxiliary transformer tapping.

3.1.2 Power Rating

This is the number of inverter/rectifier module pairs needed which is defined by the load kVA. Each module pair can deliver an apparent power (kVA) at a rated voltage according to Table 3-1: PCS100 AVC-40 module pair rated power
Note that the 8B to 12B systems are only available in 400 V and 480 V only. 12B systems are also available in 600V and 690 V.

Power Modules	Number of Module Pairs	PCS100 AVC-40
01B5	2	450 kVA
02B	2	600 kVA
02B5	3	750 kVA
03B	3	900 kVA
04B	4	1200 kVA
05B	5	1500 kVA
06B	6	1800 kVA
08B	8	2400 kVA
10B	10	3000 kVA
12B	12	3600 kVA

Table 3-1: PCS100 AVC-40 module pair rated power

3.1.3 Correction Performance

Defines sag correction performance. Correction performance of the PCS100 AVC-40 is 40%.

3.1.4 Termination Side

The location of the power terminals when viewed from the front of the transformer enclosure.

3.1.1 Market

Whether the system is for IEC or UL market. If UL is required contact the factory.

3.1.5 Options

Refer to document 2UCD074000E002 PCS100 AVC-40 Technical Catalogue for detailed information.
The following options are available:

		Availability				
Plus Code	**Option Description**	**2B**	**3B**	**4B, 5B, 6B**	**8B, 10B, 12B**	**Note**
BB	Back-to-Back Layout Plan	x	x	x	x	For the 600 V and 690 V 12B system, only the back-to-back configuration is available.
SA	Side Aperture	x	x	x		
RK	Roof Kit	x	x	x		Not available with the Cable Duct or the Termination Enclosure options
TE	Termination Enclosure	x	x	x		
TPx	Termination Palms	x	x	x		x = I for IEC or N for NEMA
PS	Redundant Power Supply Unit	x	x	x	x	

Table 3-2: PCS100 AVC-40 available options

Note that the systems 8B and above include termination palms as standard for busbar connection.

3.2 Rating label

The information relating to specific PCS100 AVC-40 is shown on its rating label. Example rating label is shown below.

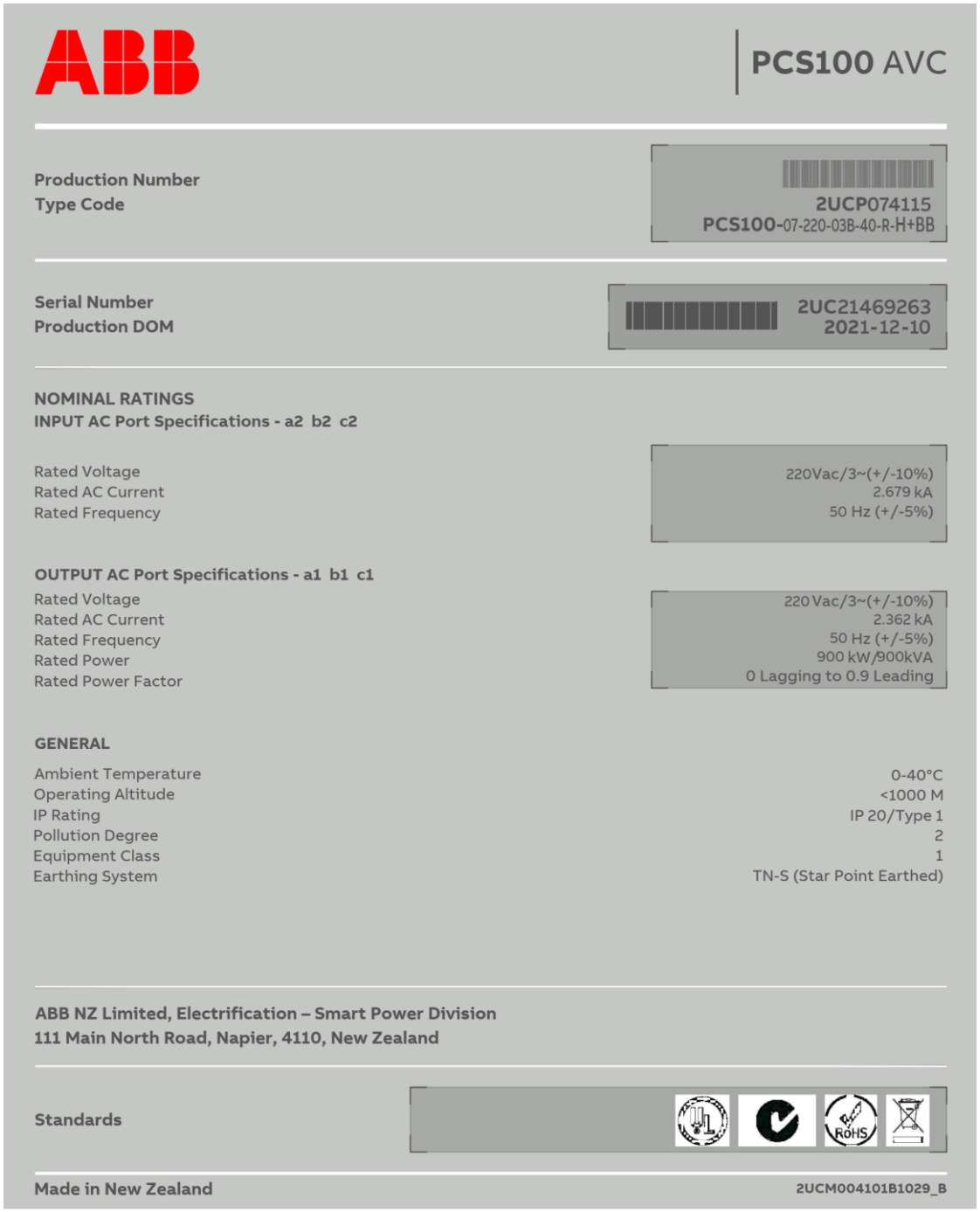


Figure 3-2: PCS100 AVC-40 rating label.

3.3 PCS100 AVC-40 Model Range

Rated power [kVA]		**Rated Input Current [A] (at 90% utility voltage)**	**Rated Output Current [A]**	**Fault Capacity [kA]**	**Losses [kW] (Typical)**	**Efficiency [%] (Typical)**	**Airflow [m3/min]**	**Frame Size**	**Type Code** **To complete the type code:** **Place R for right termination side or L for left termination side instead of y** **Place IEC if IEC required or ULF if UL field certification ready required instead of x**
220 V models									
220 V Utility Voltage	**208 V** Utility Voltage								
450	425	1350	1181	40	9.7	97.9	36	2B	PCS100-07-220-01B5-40-x-y
600	567	1791	1575	40	11.8	98.1	36	2B	PCS100-07-220-02B-40-x-y
750	709	2239	1969	50	14.5	98.1	54	3B	PCS100-07-220-02B5-40-x-y
900	851	2679	2362	50	16.4	98.2	54	3B	PCS100-07-220-03B-40-x-y
1200	1135	3567	3150	80	20.7	98.3	72	4B	PCS100-07-220-04B-40-x-y
1500	1418	4450	3937	100	25.2	98.4	90	5B	PCS100-07-220-05B-40-x-y
1800	1702	5331	4724	100	29.1	98.4	108	6B	PCS100-07-220-06B-40-x-y
400 V models									
400 V, 415 V Utility Voltage	**380 V** Utility Voltage								
450	427	742	650	31.5	8.9	98.1	36	2B	PCS100-07-400-01B5-40-x-y
600	570	985	867	31.5	10.8	98.2	36	2B	PCS100-07-400-02B-40-x-y
750	712	1232	1083	31.5	13.5	98.2	54	3B	PCS100-07-400-02B5-40-x-y
900	855	1474	1300	31.5	15.2	98.4	54	3B	PCS100-07-400-03B-40-x-y
1200	1140	1962	1733	40	19.1	98.5	72	4B	PCS100-07-400-04B-40-x-y
1500	1425	2448	2166	50	23.3	98.5	90	5B	PCS100-07-400-05B-40-x-y
1800	1710	2932	2599	63	26.8	98.6	108	6B	PCS100-07-400-06B-40-x-y
2400	2280	3938	3465	65	36.3	98.5	144	8B	PCS100-07-400-08B-40-x-y
3000	2850	4922	4331	65	47.7	98.4	180	10B	PCS100-07-400-10B-40-x-y
3600	3420	5906	5197	65	60.3	98.3	216	12B	PCS100-07-400-12B-40-x-y

Rated power [kVA]		**Rated Input Current [A] (at 90% utility voltage)**	**Rated Output Current [A]**	**Fault Capacity [kA]**	**Losses [kW] (Typical)**	**Efficiency [%] (Typical)**	**Airflow [m3/min]**	**Frame Size**	**Type Code** **To complete the type code:** **Place R for right termination side or L for left termination side instead of y** **Place IEC if IEC required or ULF if UL field certification ready required instead of x**
480 V models									
480 V Utility Voltage	**440 V** Utility Voltage								
450	413	619	542	25	8.9	98.1	36	2B	PCS100-07-480-01B5-40-x-y
600	550	821	722	25	10.8	98.2	36	2B	PCS100-07-480-02B-40-x-y
750	688	1026	903	25	13.5	98.2	54	3B	PCS100-07-480-02B5-40-x-y
900	825	1228	1083	25	15.2	98.4	54	3B	PCS100-07-480-03B-40-x-y
1200	1100	1635	1444	40	19.1	98.5	72	4B	PCS100-07-480-04B-40-x-y
1500	1375	2040	1805	40	23.3	98.5	90	5B	PCS100-07-480-05B-40-x-y
1800	1650	2444	2166	50	26.8	98.6	108	6B	PCS100-07-480-06B-40-x-y
2400	2200	3281	2887	65	34.1	98.6	144	8B	PCS100-07-480-08B-40-x-y
3000	2750	4102	3609	65	44.3	98.5	180	10B	PCS100-07-480-10B-40-x-y
3600	3300	4922	4331	65	55.4	98.5	216	12B	PCS100-07-480-12B-40-x-y

Rated power [kVA]	**Rated Input Current [A] (at 90% utility voltage)**	**Rated Output Current [A]**	**Fault Capacity [kA]**	**Losses [kW] (Typical)**	**Efficiency [%] (Typical)**	**Airflow [m3/min]**	**Frame Size**	**Type Code** **To complete the type code:** **Place R for right termination side or L for left termination side instead of y**
690 V models								
690 V Utility Voltage								
3600	3423	3012	50	505	98.5	216	12B	PCS100-07-690-12B-40-IEC-y+BB

Rated power [kVA]	**Rated Input Current [A] (at 90% utility voltage)**	**Rated Output Current [A]**	**Fault Capacity [kA]**	**Losses [kW] (Typical)**	**Efficiency [%] (Typical)**	**Airflow [m3/min]**	**Frame Size**	**Type Code To complete the type code: Place R for right termination side or L for left termination side instead of y**
600 V models								
600 V Utility Voltage								
3600	3936	3464	50	53.5	98.5	216	12B	PCS100-07-600-12B-40-IEC-y+BB

4 TECHNICAL SPECIFICATION

NOTE: These specifications apply to the standard PCS100 AVC-40 range and may be superseded by special variations stated on the PCS100 AVC-40 rating label or User Manual Addendum.

4.1 Model Range

Power range	450 kVA– 3600 kVA

4.2 Utility – Input

Rated voltage (model specific)	220 V – application range 208 V – 220 V 400 V – application range 380 V – 415 V 480 V – application range 440 V – 480 V 600 V – application range 600 V 690 V – application range 690 V Note: Application voltage lower than the rated voltage results in power derating. Consult the rating tables for more information.
Maximum supply voltage	110%
Nominal supply frequency	50 Hz or 60 Hz
Frequency tolerance	± 5 Hz
Power system	3 phase center ground referenced (TN-S) For use in other power systems refer to ABB Document 2UCD070000E025
Overvoltage category	III
Fault capacity	Refer to the model tables shown in this document.
Outage – control ride through	> 600 ms
Harmonics	IEC 61000-2-4 Class 2 (THD_V < 8%) Note: For THD_V > 8%, please refer to factory as the lifetime of components may be significantly affected

4.3 Load – Output

Voltage	To match nominal input voltage Note: output voltage can be adjusted by ± 10% with 0.1% steps
Equivalent series impedance	< 4% (model specific)
Displacement power factor	0 lagging to 0.9 leading
Crest factor	3.0
Overload capability from 100% supply voltage	150% for 30 seconds, once every 500 s
Harmonics	IEC 61000-2-4 Class 2 (THD_V < 8%) Note: For THD_V > 8%, please refer to factory as the lifetime of components may be significantly affected

4.4 Performance

Efficiency	Under nominal conditions > 98%	
Sag correction response	Initial < 250 µs Complete < ½ cycle	
Voltage regulation accuracy	±1% typical, ±2% max.	
Sag correction accuracy	±4%	
Continuous 3 phase regulation range	±10%	
Sag correction capability	40%	
Sag correction performance:		
Three phase sags	60% to 100% for 30 seconds, 50% to 90% for 10 seconds	
Single phase sags	45% to 100% for 30 seconds Note: Refer to performance curves in this document for more details.	
Partial correction derating conditions	1.0 PF at 80% load 0.8 PF at 100% load	Note: Refer to document 2UCD070000E020 PCS100 AVC Detailed Performance Curves

4.5 Internal Bypass

Capacity	100% of model rating (kVA)
Maximum overload capacity (in bypass)	125% for 10 minutes 150% for 1 minute 500% for 1 s 2000% for 200 ms
Transfer time	To bypass < 0.5 ms To Inverter < 250 ms
Equivalent series impedance	Bypass < 2.5% typical

4.6 Injection Transformer

Transformer type	Dry
Insulation	IEC 60085 Thermal class 200
Frequency	50 Hz and 60 Hz
Vector group	Diii (delta + 3 independent windings)

4.7 Standards and Certifications

Declaration of Conformity – This product conforms to the following standards.

Quality	ISO 9001	
Regional Standards	Europe	CE
	Australia, New Zealand	C-Tick
Safety	IEC 62477-1	
Electromagnetic compatibility	Emissions: CISPR 11 Class A Group 1 Immunity: IEC 61000-6-2	
Performance	IEC 61000-4-34 SEMI F47	

4.8 Environmental

Operating temperature range	0° C to 50° C (32° F to 122° F)
Temperature derating	Above 40° C (104° F), derate at 1.25% load per °C to a maximum of 50° C (122° F)
Operating altitude	<1000 m (3280 ft) without derating
Capacity derating with altitude	1% every 100 m (328 ft) above 1000 m (3281 ft) 2000 m (6562 ft) maximum
Inverter cooling	Forced ventilation
Transformer cooling	Natural convection
Humidity	< 95%, non-condensing
Pollution degree rating	2
Noise	< 75dBA @ 2 m (6.56 ft)
Storage temperature range	-30° C to 50° C (-22° F to 122° F)
Packaging	Must be kept dry at all times including transportation and storage. Protect against contact with rain or other water or liquids and do not store in damp or humid conditions.

4.9 Enclosure

Enclosure rating	IP20/NEMA 1 (IP21/NEMA2 with optional roof kit)
Material	Electro-galvanized steel
Panel thickness	
Side and rear	1.6 mm (0.063'')
Door	1.6 mm (0.063")
Finish	Powder coated ripple finish
Color	RAL7035 Light Grey
Enclosure access	Key lockable, hinged full-sized door that opens 120 degrees

4.10 Service

MTTR	30 min typical by module exchange
Diagnostics	Non-volatile event & service log
Remote monitoring	E-mail

4.11 Power Quality Event Monitor

Events recorded	voltage sags (RMS) voltage surges (RMS)
Event detection	input voltage
Sag threshold	90% of utility voltage default setting (user adjustable)
Surge threshold	110% of utility voltage default setting (user adjustable)
Accuracy	voltage: ± 2% duration: 10 ms
Remote monitoring	e-mail notification

4.12 User Interface

User interface	256 mm (10.1”) color touch panel
Touch panel	Full parameter control
Control inputs	Start / Stop / Reset digital inputs
Control outputs	Running, Warning and Fault relays
Communication	Ethernet Modbus TCP E-mail

5 SUBASSEMBLIES

The PCS100 AVC-40 consists of a voltage source inverter connected to an injection transformer which is installed in series with the supply and load. It monitors the incoming supply voltage and provides almost instantaneous correction for any disturbances.
The PCS100 AVC-40 incorporates a bypass system. Should the inverter become overloaded the bypass system shunts the Injection Transformer, relieving the load from the inverter and effectively providing a direct connection to the load.

The PCS100 AVC-40 is composed of two main subassemblies:

- Controller Enclosure(s)
- Transformer Enclosure(s)

Together these subassemblies are referred to as the PCS100 AVC-40 System. On larger PCS100 AVC-40 systems two subassemblies are housed in separate enclosures. Systems with frame size 8B and above contain two Injection Transformers, housed in two separate Transformer Enclosures.

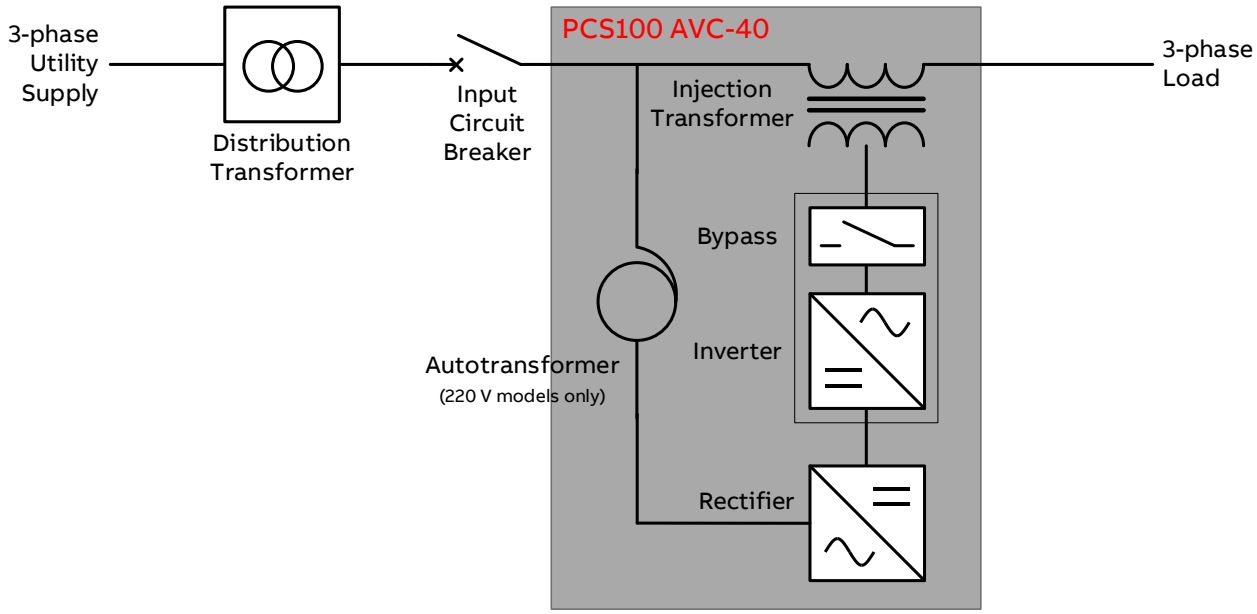


Figure 5-1: PCS100 AVC-40 SLD with enclosure definition (up to 6B frame size)

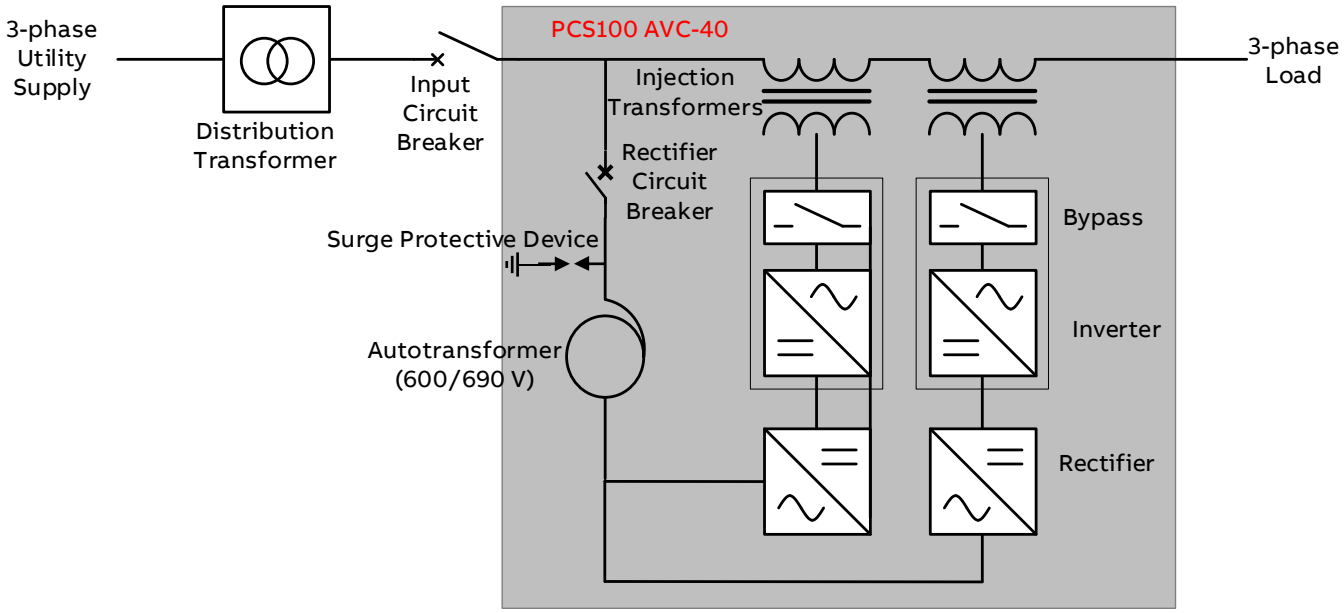


Figure 5-2: PCS100 AVC-40 600/690 V SLD with enclosure definition (12B frame size)

5.1 Controller Enclosure

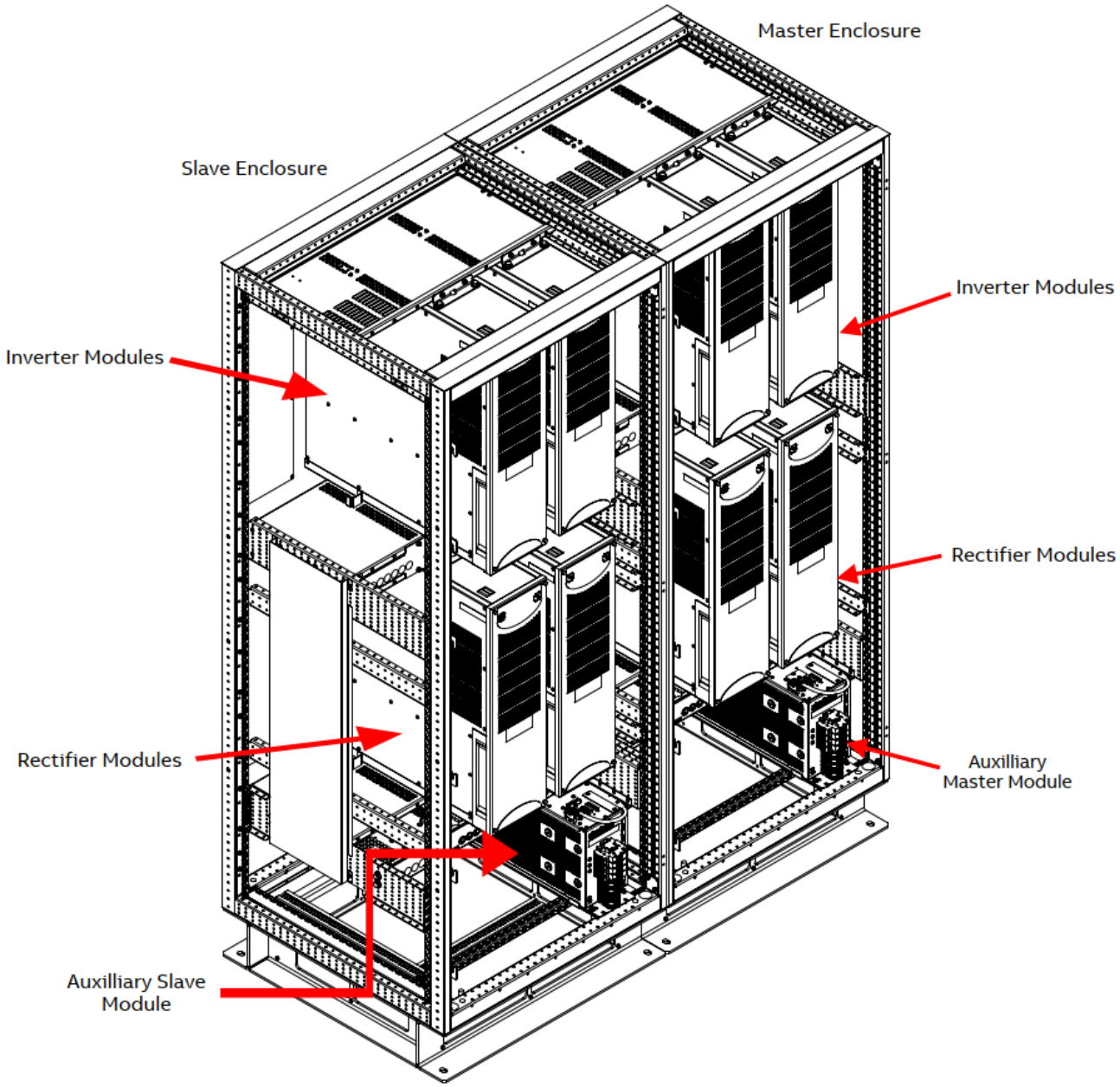


Figure 5-3: PCS100 AVC-40 4B controller enclosure.

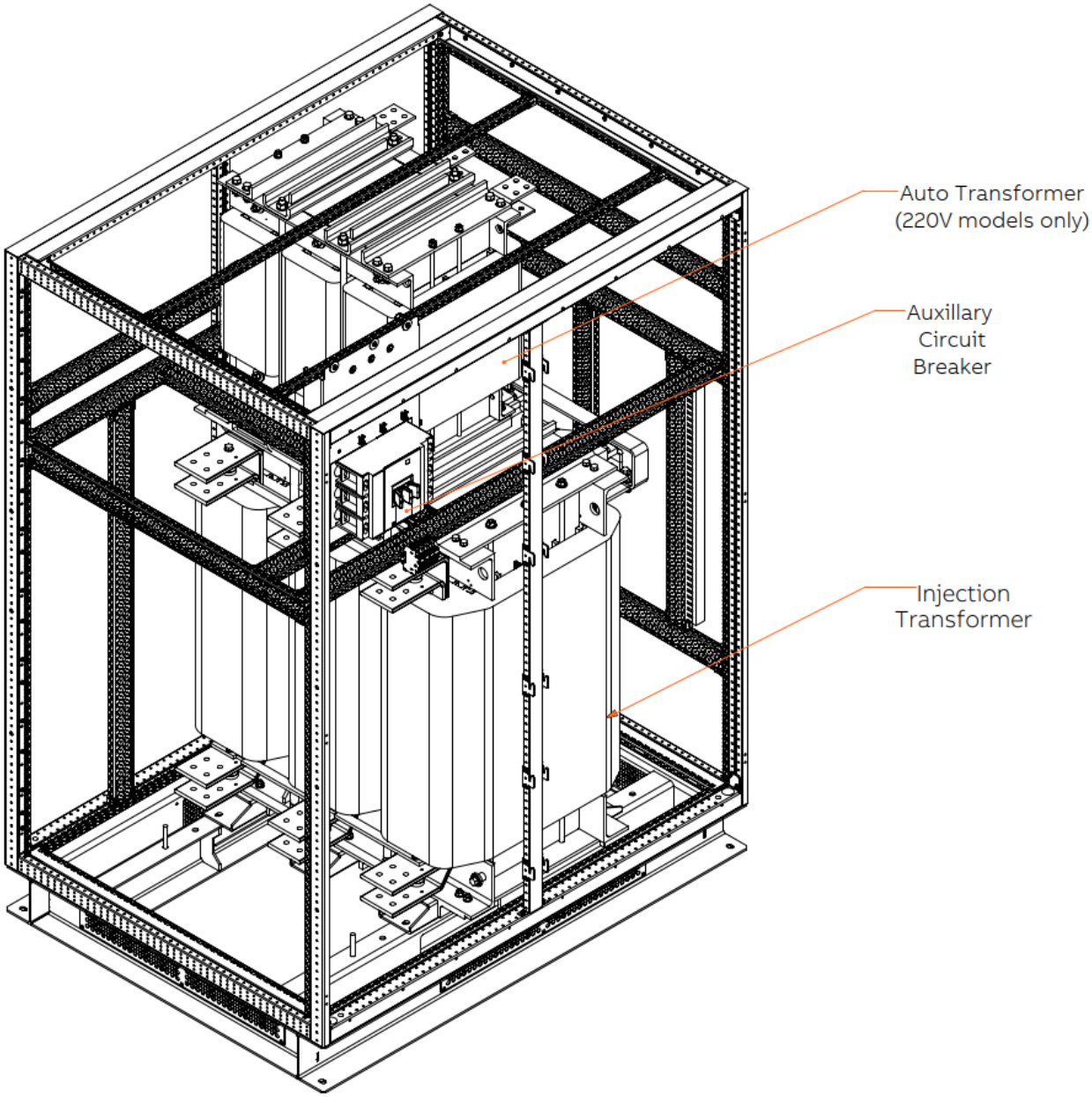


Figure 5-4: PCS100 AVC-40 4B transformer enclosure.

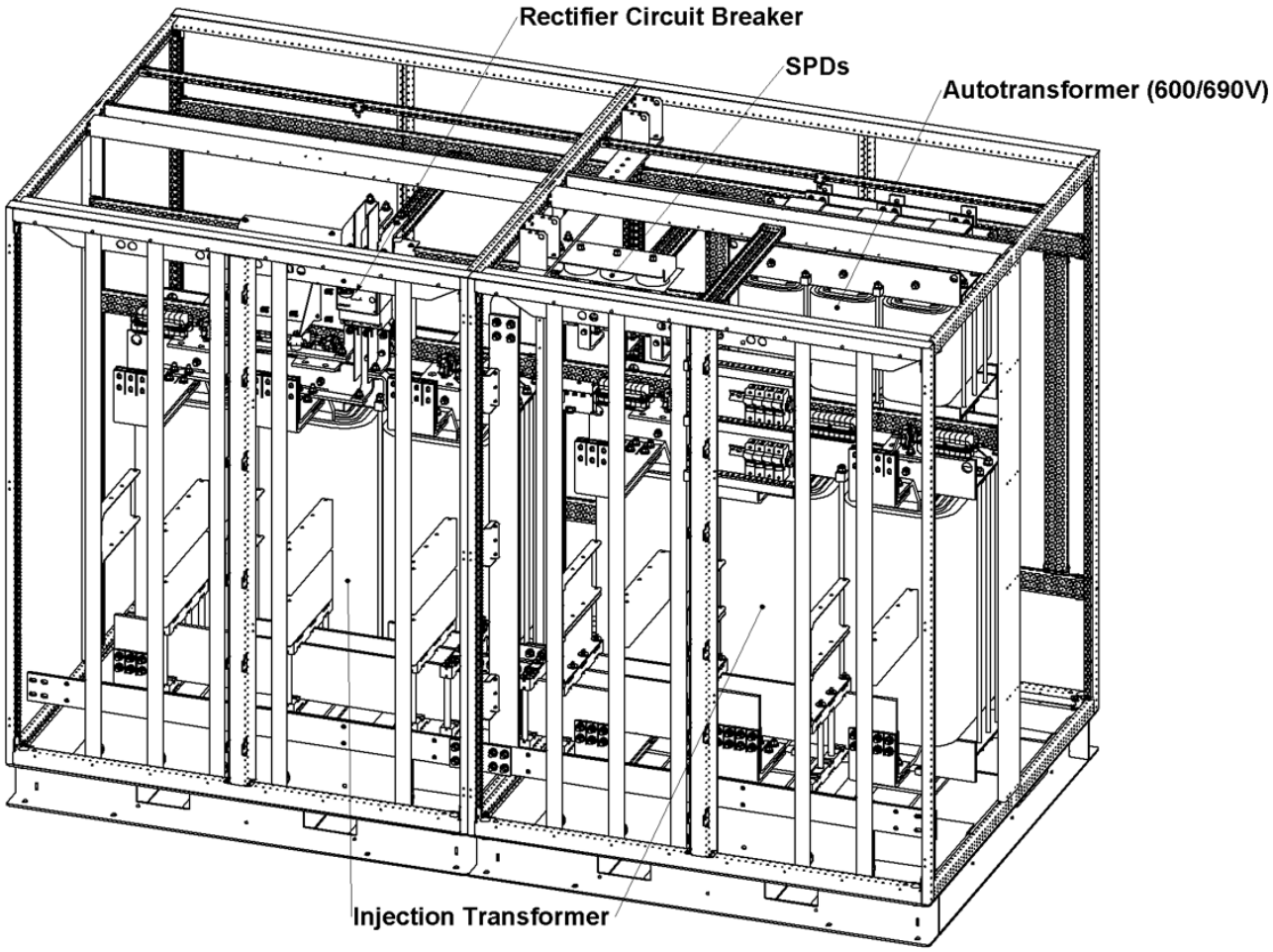


Figure 5-5: PCS100 AVC-40 600/690 V 12B (3.6 MVA) transformer enclosure.

DANGER – Hazardous Voltages
An Operator must not open doors or panels marked as containing hazardous voltages. Many parts in this product, including printed circuit boards operate at lethal voltages. DO NOT TOUCH components or connections that have voltage present.

The controller enclosure houses an appropriate number of PCS100 inverter and rectifier modules (module pairs) for the rating of the product.
Each module has a unique identification number (1 – 16), which is displayed on the front of the module.
An enclosure can have a maximum of 3 module pairs. For PCS100 AVC-40s requiring more than 3 pairs the controller is housed in multiple enclosures. The first enclosure is called the Master Controller Enclosure, and the remaining are called Slave Controller Enclosures. The Auxiliary Master Module which contains the main control electronics, and a power supply fits into the bottom of the Master Controller Enclosure. The Auxiliary Slave Module which just contains a power supply fits in the bottom of the Slave Controller Enclosure. The user interface (GDM) is mounted in the door of the Master Controller Enclosure.

5.1.1 PCS100 Rectifier Module

Figure 5-6: PCS100 power module.

The PCS100 rectifier modules convert the incoming three phase AC voltage into a regulated DC voltage.
The rectifier modules include a sine filter as part of the assembly, meaning the power electronics and sine filter are integrated into one module. Based on state-of-the-art IGBT technology and with integrated sine filters rectifier modules have minimum impact on power quality of the supply network (harmonics and power factor).

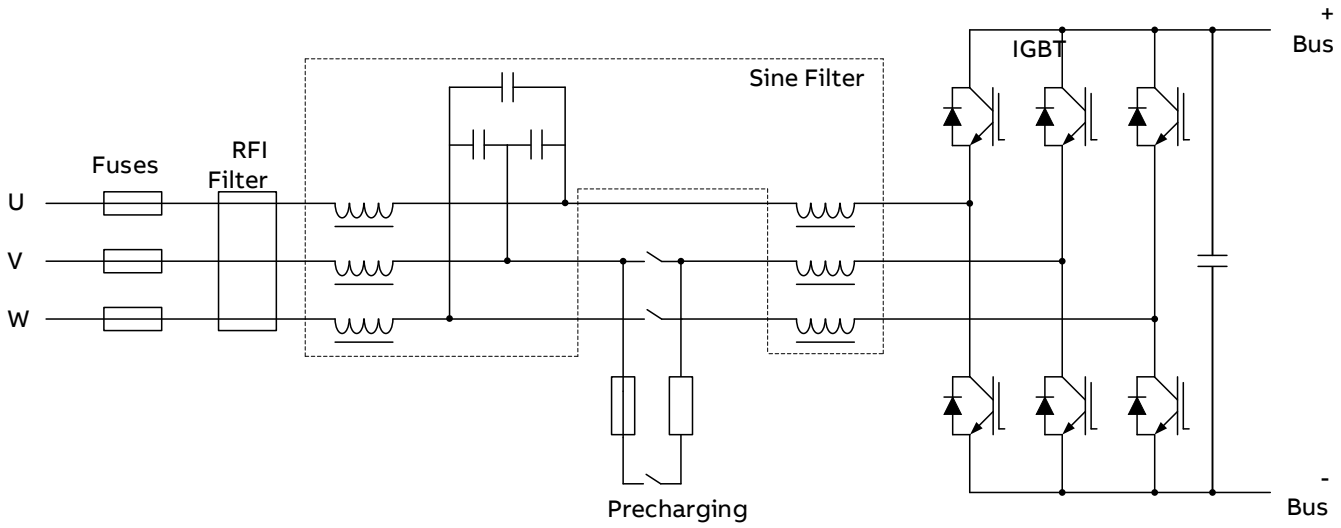


Figure 5-7: PCS100 AVC-40 rectifier diagram.

5.1.2 PCS100 Inverter Module

The PCS100 Inverter Modules are IGBT based modules that can deliver 150 A_{ac} continuously. Due to the technology used the PCS100 AVC-40 can respond within milliseconds to power disturbance events with precise control over the correction voltage. Based on state-of-the-art IGBT technology and with integrated sine filters and RFI filters inverter modules have minimum impact on power quality of the load.
The Fail-Safe Bypass circuit is included in the each PCS100 AVC-40 inverter module. The Fail-Safe Bypass circuit is designed to remove the inverter from the circuit during overload or manual bypass operating modes, by shunting the series transformer in the PCS100 AVC-40.

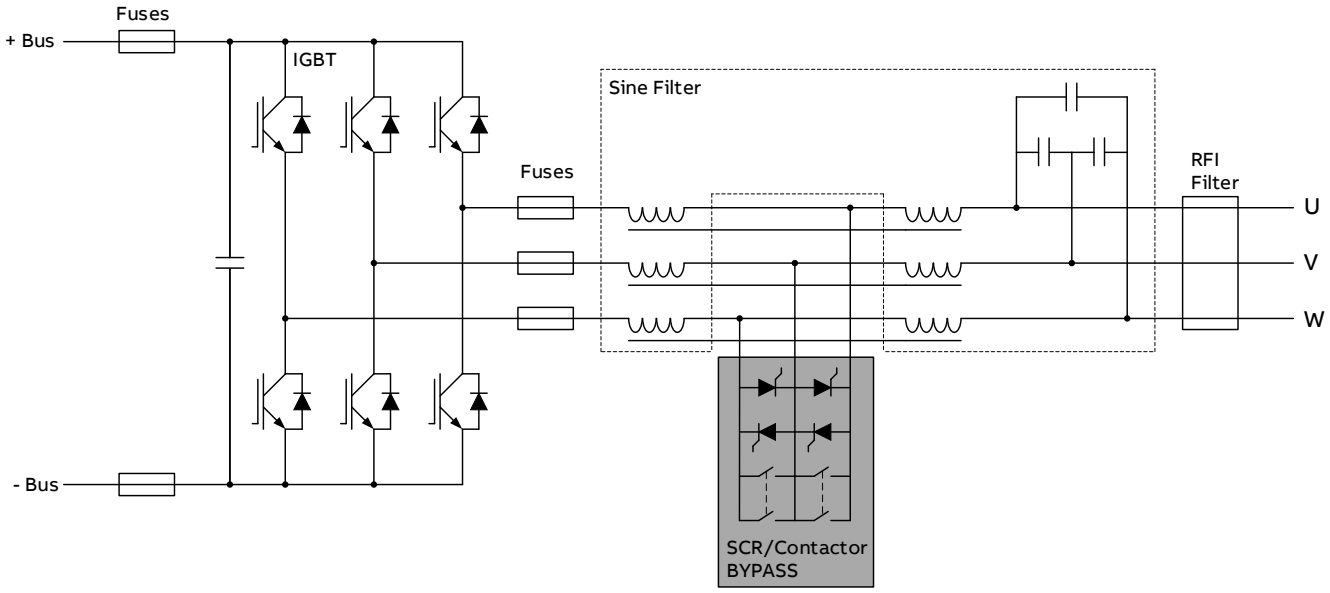


Figure 5-8: PCS100 AVC-40 inverter diagram.

5.1.3 Fail Safe Bypass

Power Quality equipment must be more reliable than the utility and must never “drop” or “lose” the load. The internal bypass is an important component to meet this requirement.
The Fail-Safe Bypass circuit is designed to remove the output inverter from the circuit during overload or manual bypass operating modes, by shunting the inverter side of the Injection Transformer.
Based on the combination of high-speed power electronic SCR switches and mechanical contactors, the Fails Safe Bypass provides two level redundancy for very fast and secure seamless shunting of the inverter without impacting the load.

5.1.4 Auxiliary Master Module

The Auxiliary Master Module controls and coordinates the overall system operation and function from a central point. The Auxiliary Master Module also controls the operating state of the system and combines the measurements and feedback from the Power Modules (Rectifiers and Inverters) into a single data set. It also identifies significant events in the external world (supply and load) and the internal system and stores them in an event log. It performs the system wide input voltage sensing and calculates the reference values for the Power Modules.
Additionally, the Auxiliary Master Module includes:

- an auxiliary supply used for PCS100 module electronics and fan supply.
- I/O module for external control and monitoring purposes

Control and monitoring wiring is explained in Section 11.

Figure 5-9: PCS100 AVC-40 Auxiliary Master Module

5.1.5 Auxiliary Slave Module

The Auxiliary Slave Module is the same as the Auxiliary Master Module except it does not contain a control logic or associated PCBs and I/O terminals. It is intended to provide power supplies, protection, and distribution to Slave Controller Enclosures of up to six Power Modules, without the intelligence provided to the entire system by the single Auxiliary Master Module. One Auxiliary Slave Module is required per Slave Controller Enclosure. Note that the 26.5 Vdc supplies developed by each Auxiliary Master Module and Auxiliary Slave Module are not referenced between enclosures.

5.2 Transformer Enclosure

DANGER – Hazardous Voltages
An Operator must not open doors or panels marked as containing hazardous voltages. Many parts in this product, including printed circuit boards operate at lethal voltages. DO NOT TOUCH components or connections that have voltage present

The Transformer Enclosure houses the Injection Transformer, autotransformer in the case of 220 V models and 600 V/690 V 3.6 MVA model and auxiliary circuit breaker.
Customer supply and load connection terminals are located in the Transformer Enclosure.

5.2.1 Injection Transformer

The Injection Transformer is connected in series with the load and injects a correction voltage to the supply voltage. It also converts the inverter output voltage (480V max) to the appropriate correction voltage level and isolates the inverter output from the load.
When internally bypassed, the Injection Transformer from an electrical perspective appears as a reactor (inductor) in series with the load.
Customer supply and load connection terminals are located on Injection Transformer. For additional information on customer connections see section 11.

5.2.2 Autotransformer

The 220 V models utilize an autotransformer to increase the utility voltage to 480 V at the rectifier input, thereby optimizing the power (kVA) rating of the PCS100 AVC-40. Conversely, the 600/690 V models employ an autotransformer to reduce the utility voltage to 480 V at the rectifier input, also optimizing the power (kVA) rating of the PCS100 AVC-40.

6 USER INTERFACE

6.1 Graphic Display Module (GDM)

The primary user interface for configuration of the PCS100 AVC-40 is via the Graphic Display Module (GDM) which is mounted in the door of the Master Controller Enclosure. It allows local control of the PCS100 AVC-40 and shows the system status and provides access to the operating parameters and event history.
The GDM interface consists of several pages; each page has the Navigation & Control Panel and the Status Bar at the top. The Navigation & Control Panel and the Status Bar are displayed at all times.
The Navigation Panel consists of buttons allowing page selection and the Control Panel consists of a Start (I) / Stop (O) / Reset button allowing local control of the product.
The Status Bar displays the current product status and any warning or fault condition that may be present.
Table 6-1 describes general features of GDM, and
Figure **6-1** displays Status page of GDM.

Feature	**GDM**
Display resolution	1024 x 600 pixels
Display size	(256.5 mm) 10.1”
Color graphic display	yes
Touch sensitive display	yes
Full descriptions of status and faults	yes
Local Start/Stop and Reset Control	yes
Status Display	yes
Parameter adjustment	yes
Number of Event Log records stored	10000
Event log can be downloaded to a PC	yes
Remote Web Pages	yes
Modbus TCP connection	yes
Multilanguage selection	yes

Table 6-1: PCS100 AVC-40 GDM features

The GDM screen consists of following parts:

1. Navigation & Control Panel
2. Status Bar
3. Page (selectable)

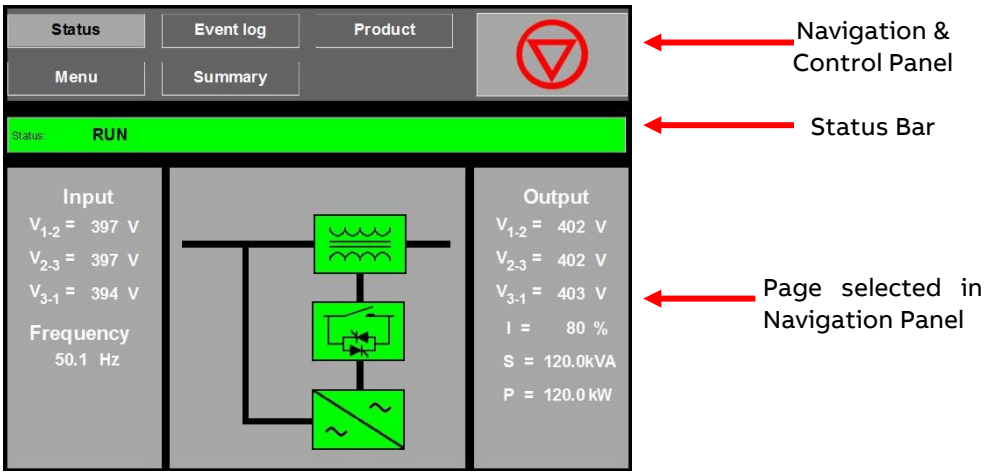
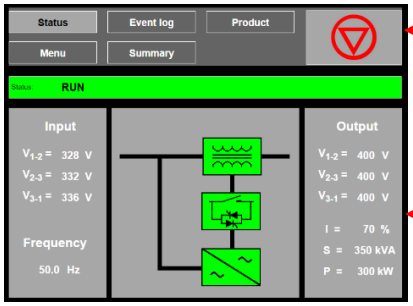


Figure 6-1: PCS100 AVC-40 GDM showing the Status page.

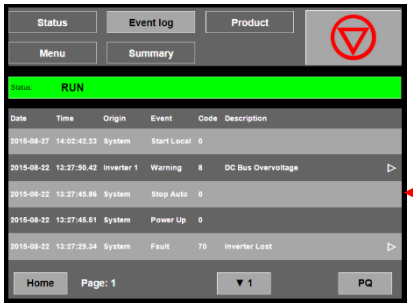
6.1.1 Navigation Panel

The navigation buttons are displayed at all times.
Press the navigation button on the Navigation & Control panel to access to the following 5 pages.

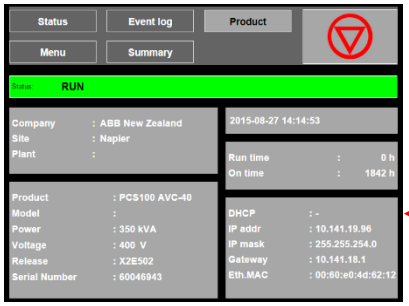
1. Status Page



2. Event Log Page

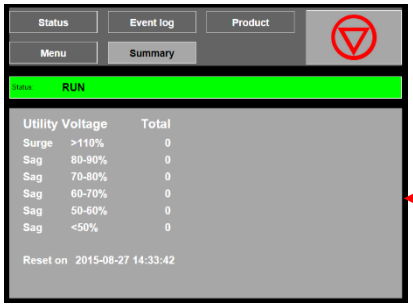


3. Product Page



4. Menu Page

5. Summary Page



Navigation Buttons

Press the Navigation buttons to access the required page

Figure 6-2: PCS100 AVC-40 GDM pages.

6.1.2 Status Page

The status page shows the input and output voltages, current and frequency. It is the default page after power. up.

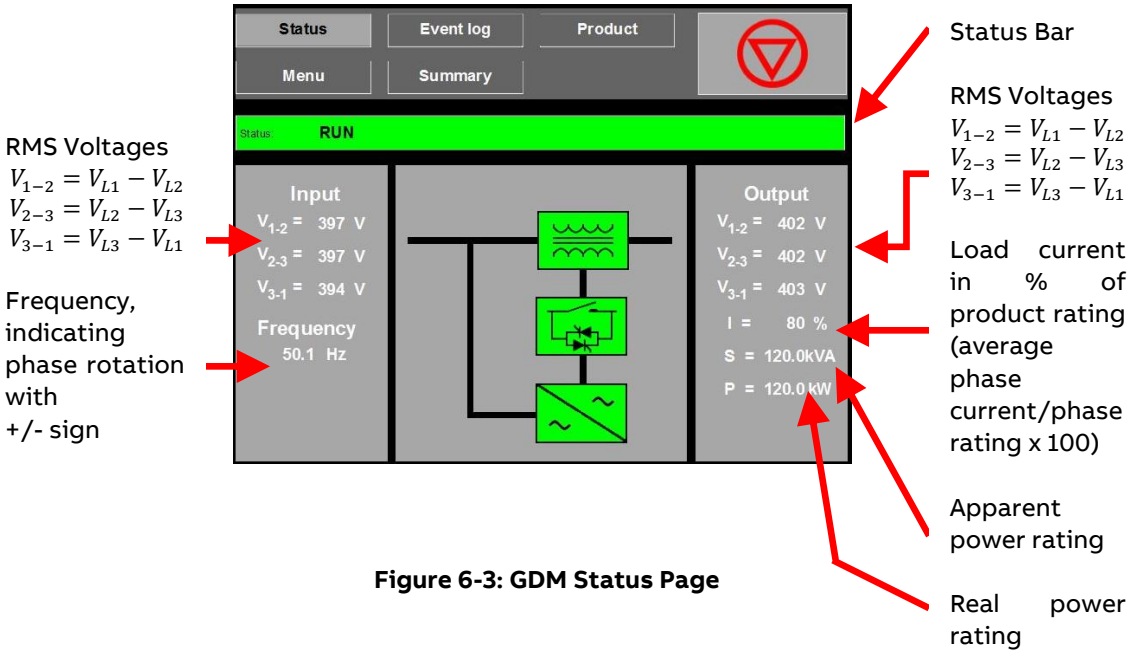


Figure 6-3: GDM Status Page

Note: These pictures are examples and the values on the display do not represent all models.

Status page of PCS100 AVC-40 in RUN status is shown on Figure 6-3.

Status page of PCS100 AVC-40 in bypass mode is shown on Figure 6-4.

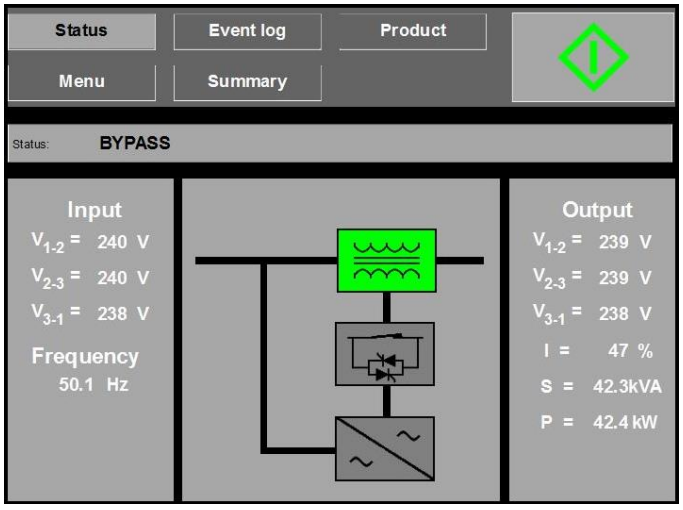


Figure 6-4: GDM status page in bypass.

6.1.3 Status Bar

The Status Bar displays the PCS100 AVC-40 status and any warning or fault code (if present).

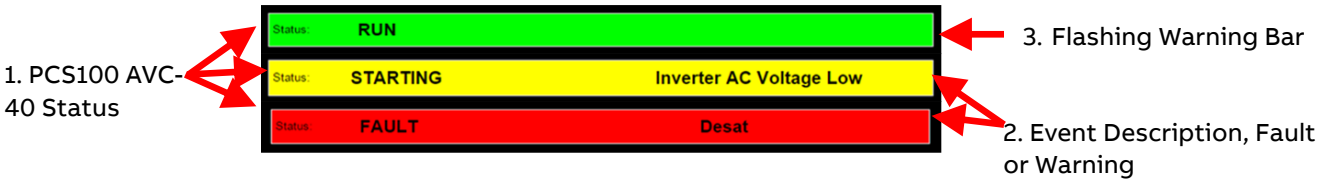


Figure 6-5: PCS100 AVC-40 Status Bar examples.

1. PCS100 AVC-40 Status: Refer to Table 6-2 for a complete list of status messages. See also Figure 6-6: PCS100 AVC-40 state flow
2. Fault or Warning description: The event code number can be found in the event log. Refer to Table 9-2 for a complete event description.
3. Yellow Warning Bar will be displayed if any warning condition exists.

Note:
The Status Bar will only display the most recent event or what is considered the most important event. Touch the Status Bar and a list of all faults and warnings presently active will be displayed.

Note:
Rectifier and inverter module warning events are not visible in the Status Bar.
To see rectifier and inverter module warnings check the Event Log.

Color of status bar depends on PCS100 AVC-40 status.
Table 6-4 shows all PCS100 status messages.
Figure 6-6 shows PCS100 AVC-40 state flow diagram.

Status	Status Bar Color	Description
RUN	Green	The PCS100 AVC-40 is functioning normally. The AC load is supplied through the series connected Injection Transformer. When the utility input deviates from nominal, due to voltage sags, surges, undervoltage, overvoltage or imbalance, the inverter will inject a correcting voltage via the Injection Transformer. The control electronics are on. The power electronics are on. Warning conditions will be displayed if present.
RUN with Warning	Yellow	The PCS100 AVC-40 is functioning normally but a warning condition exists. Most warning conditions will not affect the performance or correction ability of the PCS100 AVC-40; however sustained operation with the warning condition present could lead to an Auto Bypass or Fault response. In some situations, the warning condition may cause the correction to be modified to sustain it for a longer period of time. The warning code will show on the user interface and will be stored in the system event log. Refer to Section 9 for a description of the warning codes. Examples of warning conditions include overload and temperature warning conditions.
BYPASS	Grey	With the PCS100 AVC-40, Bypass and Off are the same. The bypass circuit shunts the inverter side of the Injection Transformer, bypassing the inverter providing a direct utility supply to the output without interrupting the load. This mode is entered from either a local or remote stop command from the user, or a reset from a fault condition. To transition to RUN operation either a local or remote start command is required. The control electronics are on. The power electronics are off.
BYPASS with Warning	Yellow	The PCS100 AVC-40 is in Bypass and a warning condition exists. The warning code will show on the user interface and will be stored in the system event log. Refer to Section 9 for a description of the warning codes.

AUTO BYPASS	Yellow	The PCS100 AVC-40 has automatically gone into Bypass as a result of an external event (E.g., an overload), but will automatically return to Run after the event has passed. The bypass circuit shunts the inverter side of the Injection Transformer, bypassing the inverter and effectively providing a direct utility supply to the output without interrupting the load. All auto bypass conditions are recoverable and once the condition has passed the PCS100 AVC-40 will automatically transition back to RUN. Status “AUTO BYPASS” (ABYPASS) will show on the user interface. The auto bypass code will also show on the display, and any auto bypass events will be stored in the system event log. Refer to Section 9 for a description of the auto bypass codes. The control electronics are on. The power electronics are on.
FAULT	Grey with red flashing bar	The PCS100 AVC-40 has experienced a fault condition, the bypass circuit will shunt the inverter side of the Injection Transformer, bypassing the inverter and effectively providing a direct utility supply to the output, without interruption to the load. This is a latched condition and the PCS100 AVC-40 will remain in “FAULT” with the bypass closed until reset by the operator. Refer to Section 9 for a description of the fault codes. The control electronics are on. The power electronics are off. Examples of auto bypass conditions include low utility voltage and over-temperature or over-current conditions. Status “FAULT” will show on the display, along with the current fault code. The fault will also be reported as an event in the system event log. Examples of fault conditions include inverter transistor de-saturation, sustained over-temperature or over-current conditions, communications lost between modules in the system. Some fault conditions such as de-saturation conditions cannot be reset until after a cooling period has expired.
STARTING	Yellow	The PCS100 AVC-40 is transitioning from BYPASS or AUTO BYPASS to RUN i.e., as the result of user start command or recovery from some auto bypass conditions. The product may be held in STARTING for a period of time until all conditions have cleared and then complete the transition to RUN.
STOPPING	Yellow	The PCS100 AVC-40 is transitioning from RUN to BYPASS or AUTO BYPASS i.e., as the result of user stop command, or an external event causing some auto bypass condition.

Table 6-2: PCS100 AVC-40 status messages details

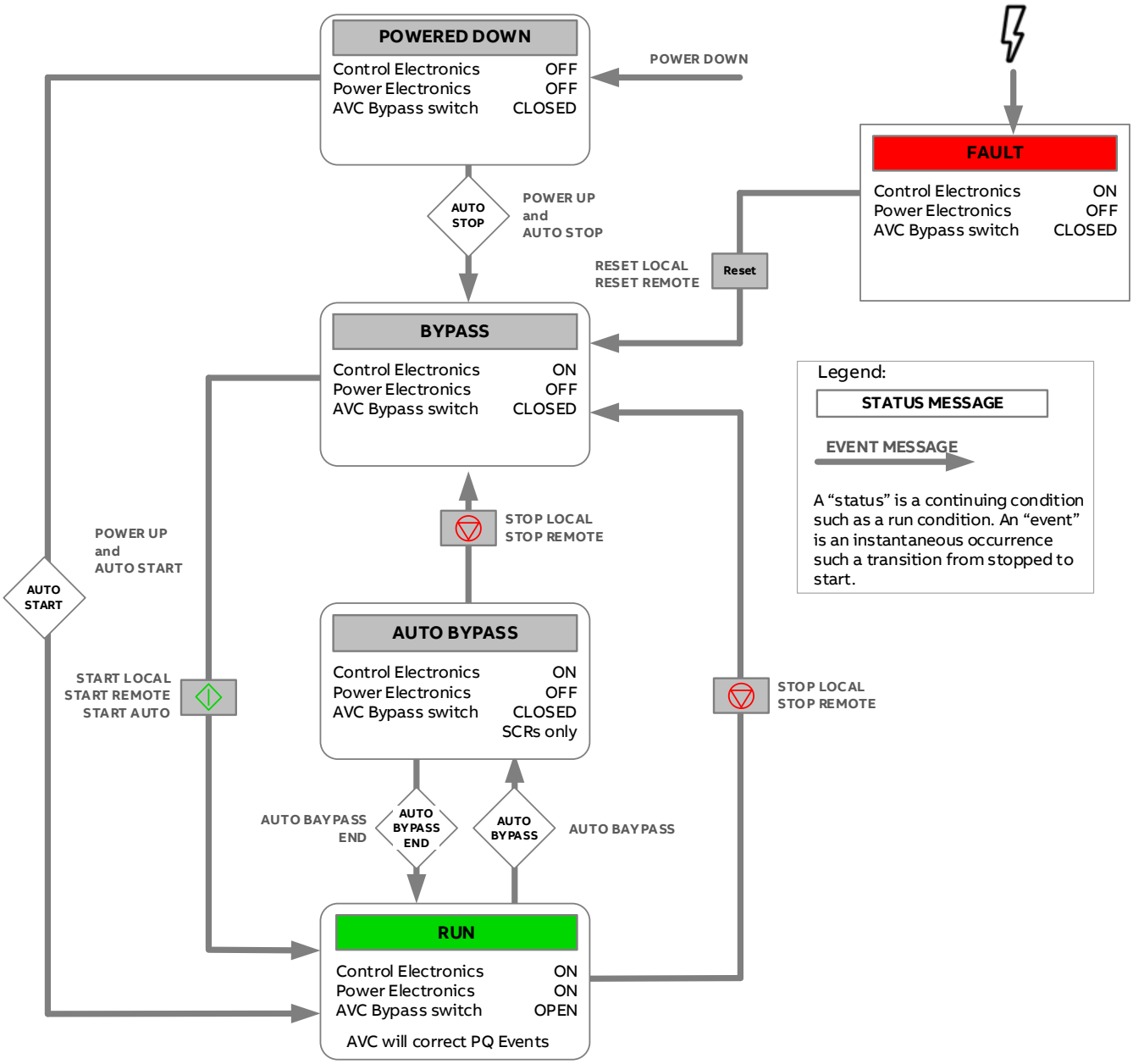


Figure 6-6: PCS100 AVC-40 state flow diagram.

6.1.4 Event Log Page

The PCS100 AVC-40 incorporates a GDM event log page that stores a chronological list of events, which is useful for diagnosing PCS100 AVC-40 operation and power quality events.

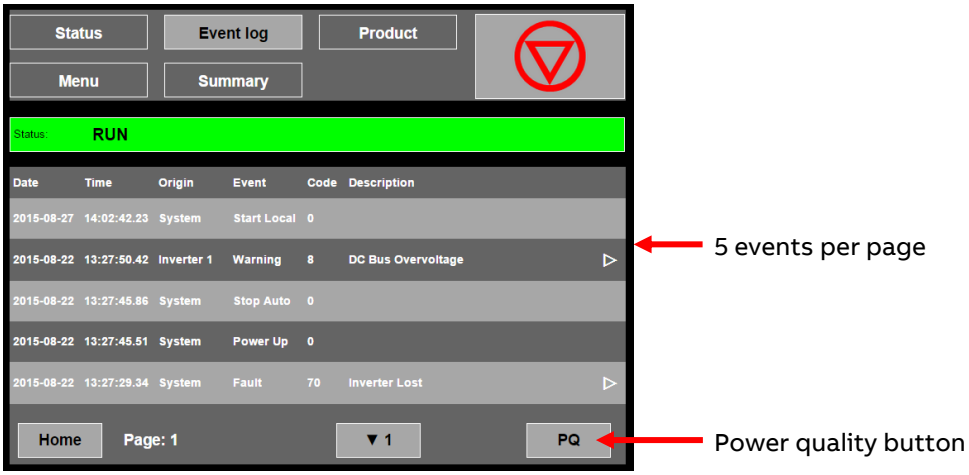


Figure 6-7: GDM event log page.

The GDM event log page provides access to the Power Quality event log (via the power quality button) which stores a chronological list of power quality events. Pressing the 'All' button will revert the screen to the GDM event log page, shown in Figure 6-7.

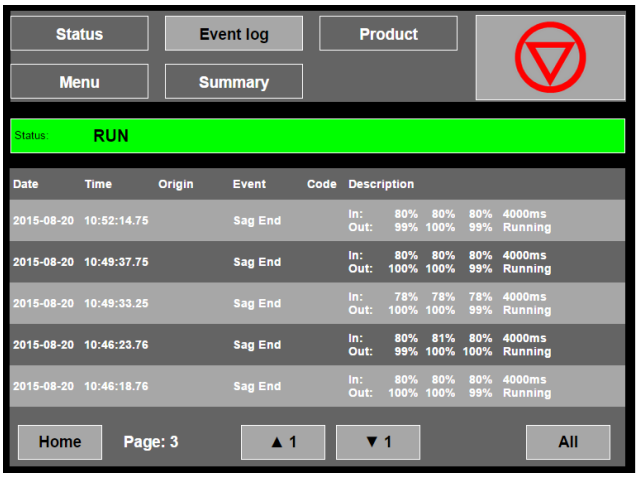


Figure 6-8: Power quality event log page.

Accessing the pages of either of the event logs uploads the most recent event records at the top. Each page shows five event records referenced by the date and time.
The records of both types of event logs can be scrolled through using the up 1, down 1, up 10 and down 10 arrow keys at the bottom of the page. The page number is shown at the bottom of the screen. Pressing the Home button will return to page 1 and upload the most recent event records in the system.
A maximum of 10,000 events can be recorded. When more than 10,000 events occur, the new events replace the oldest events.
The GDM and Power Quality event logs cannot be cleared.

6.1.4.1 Interpreting the Event Log

Figure 6-7 and Figure 6-8 show typical GDM and Power Quality event log pages, respectively.
The events recorded in the GDM event log are divided into 2 categories:

1. System events, i.e., PCS100 AVC-40 faults, warnings etc.
2. Power Quality events, i.e., voltage sags and voltage surges.

The Power Quality event log records only the Power Quality events.

6.1.4.2 System Events

Each System Event is displayed on a single line which displays the following information:

Information Type	Description
Date	The date the event occurred
Time	The time the event occurred (to 10ms resolution).
Origin	Fault, Warning and Auto Bypass events may originate from the Master, Rectifier, or Inverter modules. See Table 6-5
Event	The event types. See Table 6-4 and Table 6-7
Code	The unique numerical code for the event. See Table 9-2.
Description	For a system event this column shows a description of any Fault, Warning or Auto Bypass. See Table 9-2 for a full list of the event descriptions.

Table 6-3: Event log columns

Event Type	Description
Start Local	Local Start Command
Stop Local	Local Stop Command
Reset Local	Local Reset Command
Start Remote	Remote Start Command, (including Modbus)
Stop Remote	Remote Stop Command, (including Modbus)
Reset Remote	Remote Reset Command, (including Modbus)
Start Auto	Automatic Start e.g., return to RUN operation after Auto Bypass condition or Power Up
Stop Auto	The PCS100 AVC-40 has gone into “stopped” state after a power up.
Info	Indicates a change in Status.
Fault	Fault condition detected. See Table 9-2 for a full list of the fault codes.
Warning	Warning condition detected. See Table 9-2 for a full list of the warning codes.
Auto Bypass Start	Start of an auto bypass condition. See Table 9-2 for a full list of the auto bypass codes.
Auto Bypass End	End of an auto bypass condition
Power Up	Power Up
Clock Set	The time has been changed. The amount the time in seconds has changed by is also displayed

Table 6-4: System event types

Origin	Description
System	Events originating from the master module.
Rectifier	Events originating from rectifier module. 1 to 16
Inverter	Events originating from inverter module.1 to 16

Table 6-5: System event origins

Power Quality Events

Each Power Quality Event is displayed on two lines. Each line displays the following information:

	Value	Description
Line 1	Date	The date the event occurred
	Time	The time the event occurred (to 10ms resolution).
	Event	The event type – see Table 6-7: Power quality event types
Line 2	Status	The PCS100 AVC-40 status at the end of the event. See Table 6-2.
	Duration	The time between event start and event end in milliseconds.
	Input Voltages	Sag minimum line-to-line voltage over duration of event. Surge maximum line-to-line voltage over duration of event.
	Output Voltages	Sag minimum line-to-line voltage over duration of event. Surge maximum line-to-line voltage over duration of event.

Table 6-6: Power quality event information

Note: The input and output voltages are recorded at the end of a sag or surge. There will always be three voltages recorded. Only one voltage is required to trigger the event; however, the voltages of the other two phases will be recorded regardless of whether above or below the thresholds.

Event Type	Description
Sag End	End of sag
Surge End	End of surge

Table 6-7: Power quality event types

6.1.4.3 Additional Event Information

For events in the event or fault log pages that display an ▷ icon, clicking the respective line in the event log displays additional information about the event.
The Modules section displays which of the PCS100 modules in the PCS100 AVC-40 are reporting the event.
The Description field contains an extended description of the event.
The Recommended Action field is only visible when logged into the GDM at the 'Tech' level as it is primarily provided to aid trained ABB service agents resolve the fault.
Both the Description and Recommended Action fields are also presented in the Table 9-2.

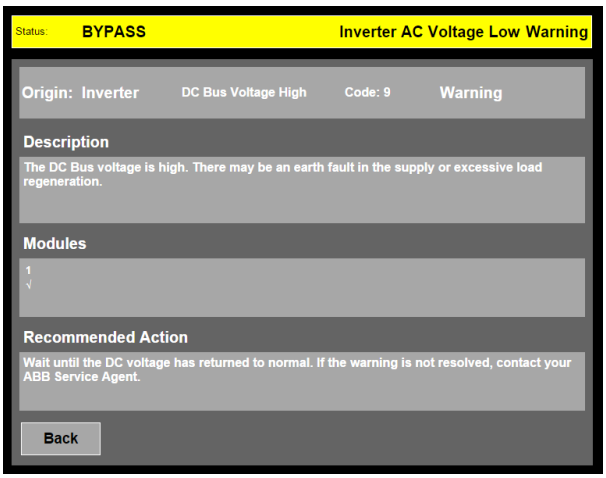


Figure 6-9: Additional event information.

6.1.5 Product Page

The product page records information about the product and the site.

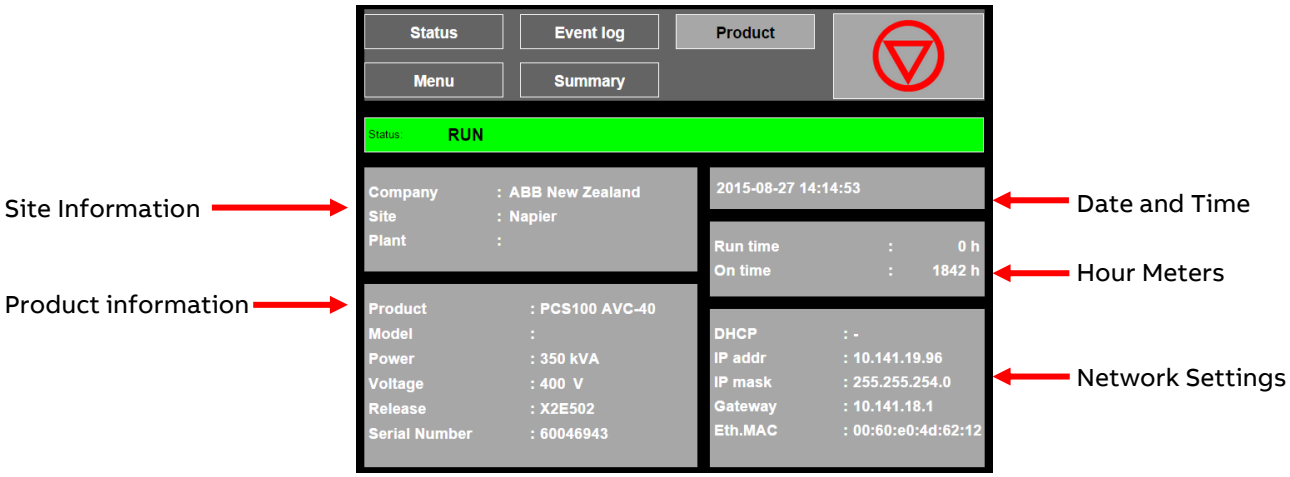


Figure 6-11: Product page.

The information displayed on the Product Page:

Item	Description
Site Information	Name of Company, Site and Plant Entered during commissioning in Menu 0 General
Product Information	Product Name and Model Power and Voltage rating SW version and Serial No. Entered during production
Date and Time	Current Date and Time Entered in Menu 0 General
Hour Meters	Total hours running and total hours on (powered up)
Network Settings	Ethernet network parameters Entered in Menu GDM B00 Network Settings

Table 6-8: Information displayed on product page.

6.1.6 Menu Page

The menu provides access to the PCS100 AVC-40 and GDM parameters for viewing and/or adjustment.
It is organized into menus and sub menus which contain the parameters. Each folder and parameter is indexed by three characters to the left of the name.
The navigation panel shows the current position in the menu.

For a full listing and description of the menu parameters refer to Section 8.

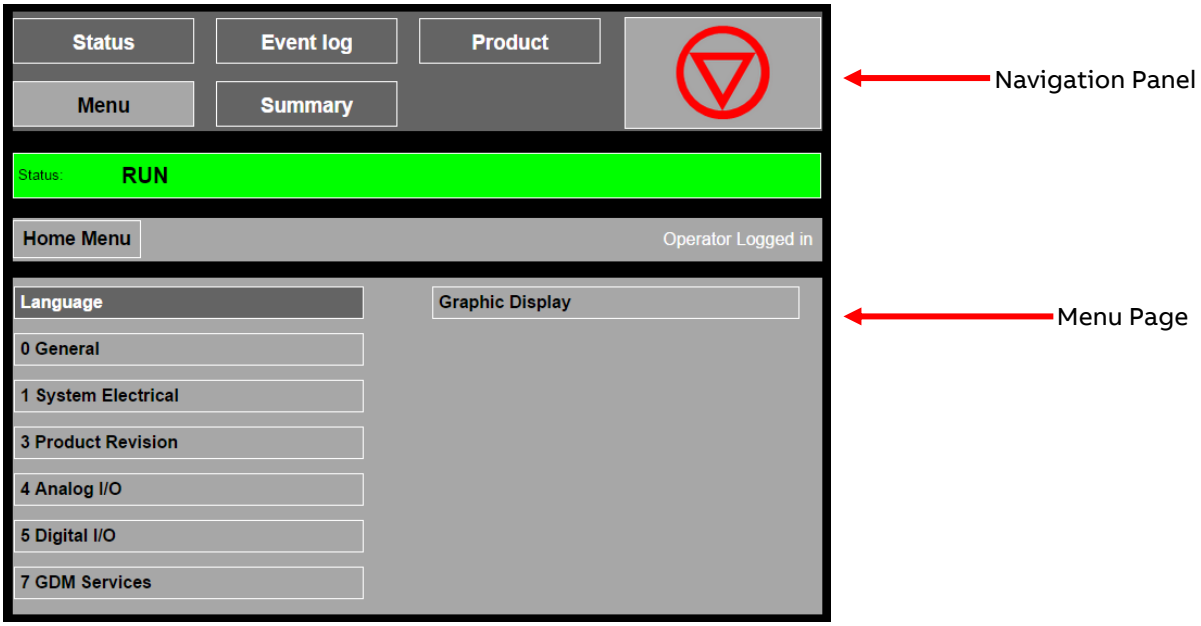


Figure 6-12: GDM menu page.

6.1.7 Summary Page

The Summary Page shows the running totals of power quality events in various voltage ranges.
The totals are cleared via parameter **06 Reset Power Quality**.
The time the summary was last cleared is shown at the bottom of the page.

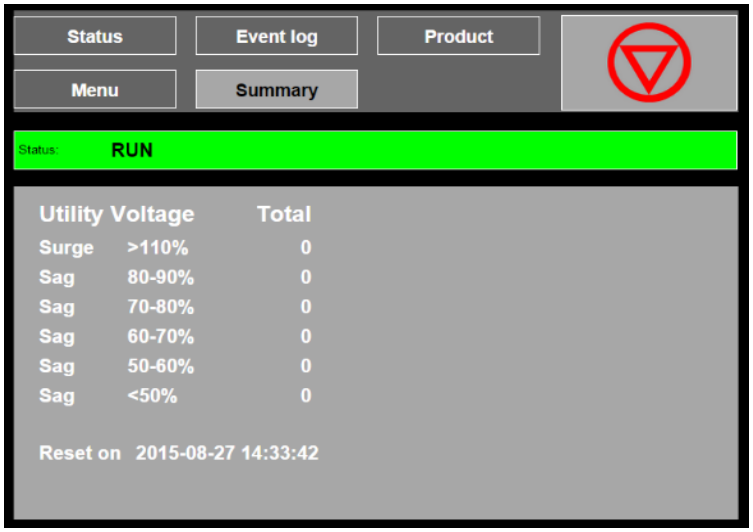


Figure 6-13: GDM summary page.

6.2 Module Display Boards

The rectifier and inverter modules contain their own display boards which contain the RUN and OK LEDs, as well as 2 x 7 segment LED displays.
The 7 segment displays show the individual module identification number (1 – 32), however if there is an error condition, they will flash alternately every 500 ms the module identification number and an error code. On start-up they will show L0 and L1 indicating the states in the start-up sequence.

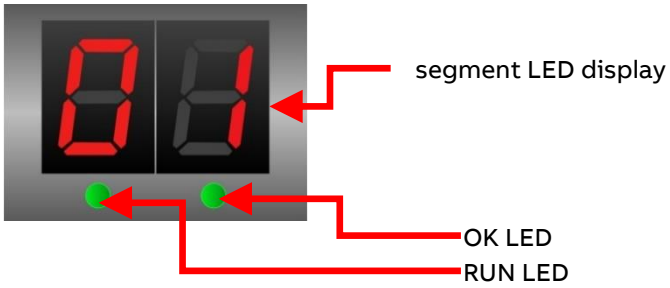


Figure 6-14: Module status LEDs.

7 segment LED display	Product Status or Description
OFF	Not powered
Module number	PCS100 AVC-40 is running
L0 and module number FLASH (50% duty, 1sec period)	Booting. This is normal during start up.
L1 and module number FLASH (50% duty, 1sec period)	Configuring. This is normal during start up.
E0 and module number FLASH (50% duty, 1sec period)	A fault has occurred in the module. See error message on GDM
E1 and module number FLASH (50% duty, 1sec period)	No communication with the main DSP (digital signal processor) controller in the auxiliary master module. Possible DSP hardware failure.
E2 and module number FLASH (50% duty, 1sec period)	Problem starting the module – invalid module configuration or invalid module parameter/s.
E3 and module number FLASH (50% duty, 1sec period)	Communications error
rE and module number FLASH (50% duty, 1sec period)	The module is running, and it has been configured as rectifier (input). This is displayed for about 2 minutes after configuration (L1) is completed.
Ou and module number FLASH (50% duty, 1sec period)	The module is running, and it has been configured as inverter (output). This is displayed for about 2 minutes after configuration (L1) is completed.

Table 6-9: 7 segment LED displays

OK LED	Product Status or Description
OFF	Not powered
ON	No fault and microprocessor functioning
FLASH (50% duty, 1sec period)	FAULT, WARNING (temperature or overload warnings) or module boot up stage.

Table 6-10: OK LED displays

RUN LED	Product Status or Description
OFF	Module stopped
ON	Module active
FLASH	Module starting

Table 6-11: RUN LED displays.

7 OPERATING THE PCS100 AVC-40

7.1 Starting and Stopping the PCS100 AVC-40

The primary method of starting and stopping the PCS100 AVC-40 is via the Graphical Display Module (GDM) which is mounted in the door of the Master Controller Enclosure. This is deemed Local Control. Start/Stop control of the PCS100 AVC-40 via the digital I/O terminals (Section 11.1. Control Connection
) is deemed Remote Control.

7.1.1 GDM Control

The Start (I) / Stop (O) /Reset button in the Navigation & Control Panel allows GDM control of the PCS100 AVC-40. When the PCS100 AVC-40 is stopped (Bypass) a green Start (I) button will show, and when running (RUN) a red Stop (▽) button will show. Pressing the Start (I)/ Stop (▽)/ Reset button followed by YES in the following confirmation screen will cause that action to be taken. Figure 7-1: GDM Status Page shows the status page when the PCS100 AVC-40 is running.

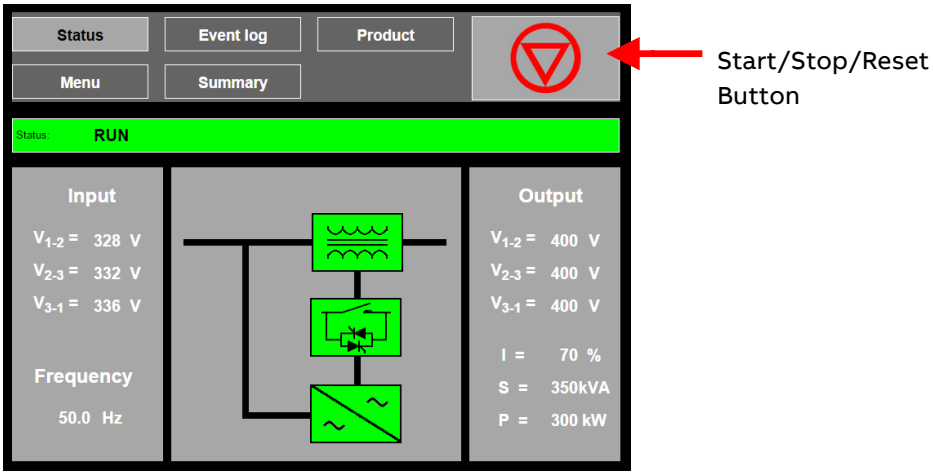


Figure 7-1: GDM Status Page

Note: If parameter **A31 GDM Control Enable** is set to False the Start/Stop/Reset button will not be displayed.

Start the PCS100 AVC-40

Figure 7-2: Start button.

The Start button is visible when the PCS100 AVC-40 status is Bypass (Off).

Press the Start button and press “Yes” at the confirmation screen. The PCS100 AVC-40 will transition to RUN operation in approx... 1 sec.

Stop the PCS100 AVC-40

Figure 7-3: Stop button.

The Stop button is visible when the PCS100 AVC-40 status is Run.

Press the Stop button and press “Yes” at the confirmation screen. The PCS100 AVC-40 will transition to Bypass (Off) in approx... 1 sec.

Reset the PCS100 AVC-40

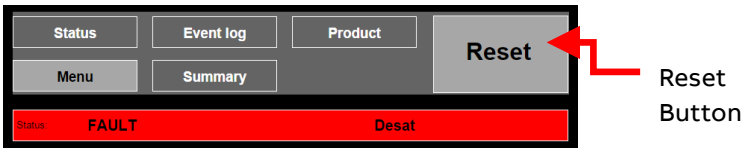


Figure 7-4: Reset button.

The Reset button is visible when the PCS100 AVC-40 status is Fault.

Press the Reset button and press “Yes” at the confirmation screen to reset a fault.

Start Inhibit

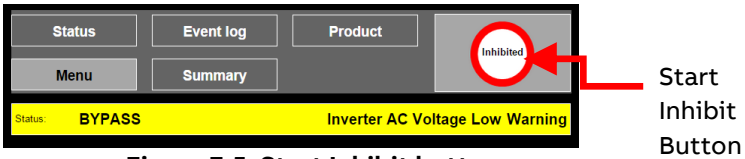


Figure 7-5: Start Inhibit button.

The Inhibit button is visible when the Inhibit switch or the remote stop input is closed.

The PCS100 AVC-40 cannot be operated until these inputs are closed.

The Inhibit switch is inside the Master enclosure door.

The remote stop input is on the front of the Auxiliary Master Module, see Section 11.1. In this state the PCS100 AVC-40 cannot be started via the GDM control panel.

7.1.2 Remote Control

Start, Stop & Reset control via the digital inputs on the front of the Auxiliary Master Module (see Figure 11-4: Customer Terminals for Remote Control and Monitoring of PCS100 AVC-40) is deemed “Remote Control.”

Control	Method
Start	When the Start input closes (terminals 12 & 13) the PCS100 AVC-40 will start (Online) in approx. 1 sec.
Stop	When the Stop/Reset input opens (terminals 14 & 16) the PCS100 AVC-40 will transition to stop (static bypass) in approx. 1 sec. The stop always has priority over the start.
Reset	When the Stop/Reset input transitions from open to close the PCS100 AVC-40 will reset when a fault condition exists if the cause of the fault has been cleared.

Table 7-1: Remote Start/Stop control.

A Stop input has priority over any Start command. When a Remote Stop is active “INHIBITED” will show on user interface as shown above.

7.1.3 Start/Stop Configuration

The PCS100 AVC-40 is configured for GDM control by default in the factory, i.e. Stop/Reset/Inhibit input is linked out and Stop-Enable switch is wired in series as shown on Figure 11-2.

The start status will be retained through a power down cycle and the PCS100 AVC-40 will return to the previous operation after the next power up.

7.2 Output Voltage Set Point

PCS100 AVC-40 provides the ability to adjust the output voltage and the output voltage reference source.

The output voltage reference source can be the GDM screen, an analogue input or Modbus. Parameters for setting up the output voltage reference source can be found under Menu 6 References as shown in Figure 7-6 below.

For output voltage control via the GDM screen, parameter **601 V Set Source** must be set to Manual, and the voltage set point is adjusted via parameter **600 V Set Manual**. For example, in Figure 7-6 the system is set to manual control and 400 V output voltage.

In manual control, any other reference is ignored and the parameters 602, 603 and 604 are not used.

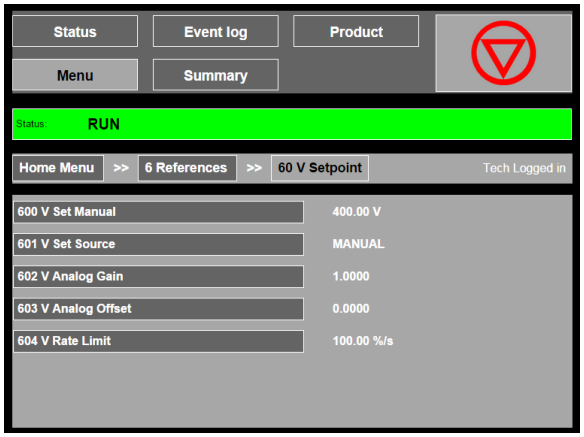


Figure 7-6: Voltage set point menu page.

Note:
A standard PCS100 AVC-40 only allows adjustment of the output voltage via the GDM (Manual) or Modbus. Remote control via an analogue input is only available with the optional CAN I/O board (Extended I/O board). Therefore, parameters relating to the CAN I/O board (Extended I/O board) are not described in this manual.

8 PARAMETERS

8.1 Parameter Setting (Menu Page)

Parameter setting is performed by the GDM Menu pages, as shown Figure 8-1.

The Menu Page is organized into menus and sub menus which contain the parameters. Each parameter is indexed up to three characters to the left of the name.

The current position in the menu is displayed in the Navigation Panel.

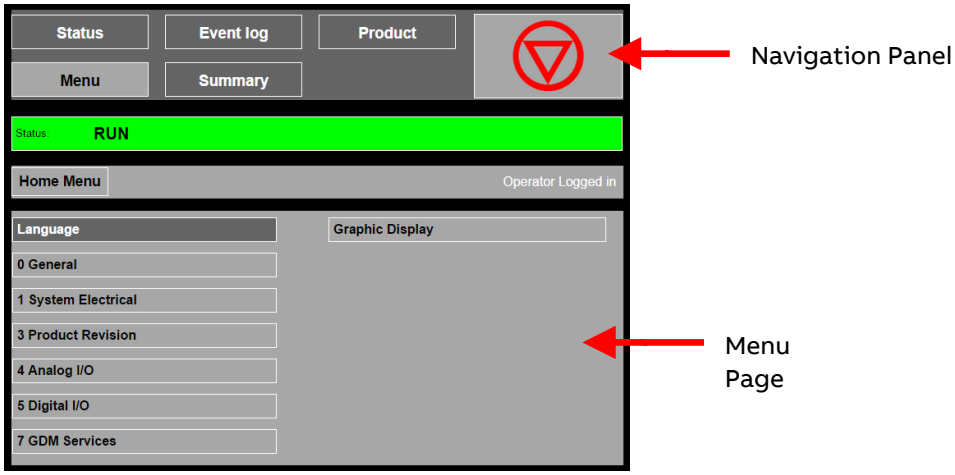


Figure 8-1: GDM Menu Page

8.1.1 Menu Navigation

Pressing on any menu folder in the Navigation Panel or Menu Page will navigate to that position in the menu and update the Navigation Panel to show the new position.
Parameters that are read only are shown in grey in the “Standard” color theme or white in the “Classic” color theme. Parameters that are adjustable are highlighted in dark grey in the “Standard” color theme or blue in the “Classic” color theme. See Table 8-2 parameter 0A for setting the GDM color theme to “Classic” or “Standard”.
Pressing on an adjustable parameter will present the “Edit Menu” screen. For numeric values this will show a keypad and for non-numeric values this will show the options for that item. Press ‘Apply’ to accept the adjustment, or ‘Cancel’ to revert to the previously stored value.
The GDM remembers the previous menu page and returns there when the user next accesses the menu.

8.1.2 Parameter Access Control

There are 2 menu levels on the PCS100 AVC-40.
Menus are security protected by a password to prevent unauthorized access.

8.1.2.1 Operator Menu

Parameters in the Operator menu are suitable for adjustment by the operator. For access enter the operator password to parameter **00 Password**.
When the Operator menu is accessible “Operator Access” is displayed in the right side of the navigation panel.

Operator password is: **159**

8.1.2.2 Tech Menu

Parameters in the Tech menu are suitable for qualified technicians. For access enter the Tech password to parameter **00 Password**.
When the Tech menu is accessible “Tech Access” is displayed in the right side of the navigation panel.

When neither menu is accessible “Not Logged In” is displayed in the navigation panel.

Note: After a menu has been active for 30 minutes it will automatically log out of that menu.

8.2 GDM Menu Index Table

Menu number & name		Parameter number & name		Page
	Language		Access to language selection page	45
0	**General**	00	Password	46
		01	Date_andTime	
		02	Customer_Name	
		03	Plant_Name	
		04	Site_Name	
		05	System_Reboot	
		06	Reset_PowerQuality	
		07	Sys_SW_Version	
		08	Set_Parameter	
		09	Show_Faults	
		0A	Color_Theme	
1	**System_Electrical**	10	System_Current	48
		11	Rectifier_Voltage	
		12	Transformer_Config	
		13	Supply_Voltage	
		14	Supply_Frequency	
		15	Sag_Threshold	
		16	Surge_Threshold	
2	**Commissioning**	20	Config_Check_Mode	49
		21	Test_Mode	
		22	Test_Voltage	
		23	Test_Frequency	
		24	Relay_Test_Mode	
		25	RMS_Line_Gnd_Test	
		26	GDM_Remote_Menus	
		27	Auto_Start	

3	**Product_Revision**	**30**	**System_Product**	**50**
		31	System_Revision	
		32	SCM_Boot_Product	
		33	SCM_Boot_Revision	
		34	SCM_Product	
		35	SCM_Revision	
		36	CGI_Revision	
		37	Modbus_Revision	
		38	NTP_Revision	
		39	Email_Revision	

Menu number & name		**Parameter number & name**				**Page**
6	**References**	60	V_Setpoint	600	V_Set_Manual	51
				601	V_Set_Source	
				602	V_Analog_Gain	
				603	V_Analog_Offset	
				604	V_Rate_Limit	
		61	Thermal_Roll_Off	610	Enable	
				611	Thermal_Set_Point	
				612	Rate_Limit	

Menu number & name	Parameter number & name						Page
7 GDM_Service	71	Webserver_Status					52
	72	Vcanserver_Status					
	73	Modbus_Service	730	Modbus Status			
			731	Data Write Enable			
			732	Control Write Enable			
	74	NTP_Status					
	75	NTP_Server					
	76	NTP_Time Zone					
	77	E-mail_Service	770	SMTP_Server			
			771	E-mail_Status			
			772	Status_Log			
			773	From_Address			
			774	Cutomer_note_1			
			775	Cutomer_note_2			
			777	Password			
			778	PQ_Events	7780	Email_Address	
					7782	Force_E-mail	
					7783	Enable	
			779	System_Events	7790	Email_Address	
					7791	Trigger Type	
					7792	Force_E-mail	
					7793	Enable	
			77A	Service_Log	77A0	Email_Address	
					77A1	Force_E-mail	
					77A2	Enable	

	Graphic Display					
GDM A00	**Display**	A31	GDM Control Enable	A62	Screen Saver Time	54
		A63	SSH Port Enable	A64	Firmware Upload Enable	
GDM B00	**Network Settings**	B11	Dynamic IP DHCP	B14	Static IP gateway	55
		B12	Static IP address	B15	Apply settings	
		B13	Static IP mask			
GDM C00	**Network Status**	C11	Actual DHCP active	C14	Actual IP gateway	55
		C12	Actual IP address	C15	MAC address	
		C13	Actual IP mask	C16	Ethernet Status	
GDM D00	**Product Revision**	D11	GDMIB boot product	D21	GDM revision	56
		D12	GDMIB boot revision	D31	$V_{canserver}$ name	
		D13	GDMIB product	D32	$V_{canserver}$ revision	
		D14	GDMIB revision			

Table 8-1: GDM Menu Index Table

Note:
Menus 4 Analog I/O and 5 Digital I/O shown in GDM Menu Page (Figure 8-1) are related to optional Extended I/O board and are not used with standard PCS100 AVC-40 operation and thereby not described in this document.
Parameter listing and description of Menus 4 Analog I/O and 5 Digital I/O are shown in separate document related to CAN I/O board.

8.3 Parameter Listing

Note:
The parameter adjustment ranges defined in the following section are not necessarily achievable due to system constraints.

Note:
Some parameter visibility depends on the login level of the user.

CAUTION – Trained Operators
All operations on the PCS100 AVC-40 must only be carried out by a trained Operator familiar with the contents of this manual. Hazardous conditions could arise from incorrect adjustment.

8.3.1 Menu Language

The Menu Language enables the user to select GDM operating language.
The following languages are available:

- English
- French
- Italian
- Malaysian
- Turkish
- Russian
- German
- Vietnamese
- Spanish
- Simplified Chinese
- Japanese
- Traditional Chinese
- Swedish
- Indonesian
- Portuguese
- Arabic
- Korean

Pressing the selected language button GDM language is instantly changed.
To return to Menu Page press Menu button.

Figure 8-2: Menu Language

8.3.2 Menu 0 General

0 General

The menu contains general system parameters

Parameter:	**00 Password**
Function:	To enable or disable access to the Operator menu or the Tech menu.
Access:	Continuous
Note	Enter 159 to access the Operator menu.
Parameter:	**01 Date and Time**
Function:	To enter the date and time.
Format:	YYYY-MM-DD HH:MM: SS
Access:	Operator
Parameter:	**02 Customer Name**
Function:	Company name entry which is displayed on the Product Page (see section 6.1.4.2) and the downloaded event log.
Access:	Operator
Parameter:	**03 Plant Name**
Function:	Plant name entry which is displayed on the Product Page (see section 6.1.4.2) and the downloaded event log.
Access:	Operator
Parameter:	**04 Site Name**
Function:	Site name entry which is displayed on the Product Page (see section 6.1.4.2) and the downloaded event log.
Access:	Operator
Parameter:	**05 System Reboot**
Function:	Restarts all functions within two minutes.
Access:	Operator
Range:	True / False
Setting Up:	Select “True” to reboot the PCS100 AVC-40. The parameter will automatically set back to “False” once the PCS100 AVC-40 has rebooted. Event 209 will be displayed in the event log.
Parameter:	**06 Reset Power Quality**
Function:	Clears the power quality events recorded in the Summary Page.
Access:	Operator
Range:	True / False
Setting Up:	Select “True” to clear the PQ events. The parameter will automatically return to “False” once the events have been cleared.
Note:	This parameter does not clear the events recorded in the Event Log.
Parameter:	**07 System SW Version**
Function:	Version of the software in the SCM
Default value	* Note: * specifies the latest version of the software
Access:	Tech
Note:	The value of this parameter should be changed under advice from the factory only. To view the current running system software version, refer the section 8.3.5 Menu 3 Product Revision

CAUTION – Trained Operators
Damage to the PCS100 AVC-40 may occur if this parameter is set incorrectly

Parameter:	**08 Set Parameter**
Function:	Provides the ability make a custom adjustment to an internal parameter.
Access:	Continuous
Range:	True / False
Setting Up:	Enter the factory supplied code to change the required internal parameter. When a correct code is entered the message “Parameter Write Result = OK” will be displayed. If an incorrect code is entered the message “Sorry, value entered is not correct” is displayed. This parameter can also be accessed via the remote web pages – see section 10.2.6.2
Note:	The code must be entered exactly. Take care when emailing such codes. Different characters look the same in some fonts. E.g., the lower-case letter L looks the same as the numeral one in Times New Roman Font. The Arial Font is OK.
Parameter:	**09 Show Faults**
Function:	Shows all the faults and warnings presently active.
Access:	Continuous
Note:	Sometimes there can be more than 1 fault or warning active at one time. The most critical fault is displayed on the Status line. This screen shows all the faults and warnings presently active.
Parameter:	**0A Color Theme**
Function:	Allows the user to choose between the standard and classic color schemes
Access:	Continuous

Table 8-2: Menu 0 General Parameters

8.3.3 Menu 1 System Electrical

1 System Electrical

The menu contains electrical settings for the product

Parameter:	**10 System Current**
Function:	Set total rated current of system – Line RMS.
Access:	Tech
Range:	0.00 A to 1751.95 A
Units:	Amps (RMS)
Factory Setting:	PCS100 AVC-40 rated current
Parameter:	**11 Rectifier Voltage**
Function:	Set typical AC (RMS) input voltage of rectifiers.
Access:	Tech
Range:	10 V to 1000 V
Default:	Model dependent
Setting Up:	Preset in the factory
Parameter:	**12 Transformer Config**
Function:	Selects the Injection Transformer terminal configuration
Access:	Tech
Range:	Top Input / Bottom Input
Default:	Top Input
Setting Up:	Preset in the factory
Note:	Top Input = utility supply (input) to top. Bottom Input = utility supply (input) to bottom. Changing this setting alone does not change the transformer configuration. Wiring changes are also required.
Parameter:	**13 Supply Voltage**
Function:	Adjusts the PCS100 AVC-40 working voltage
Access:	Tech
Range:	0.00 V to 1599.95 V
Default:	Nameplate rating of PCS100 AVC-40
Setting Up:	Set to nominal supply voltage ± 10% (RMS)
Parameter:	**14 Supply Frequency**
Function:	Set the supply voltage frequency.
Access:	Tech
Range:	40 Hz to 400 Hz
Default:	Nameplate rating of PCS100 AVC-40
Setting Up:	Set to nominal supply frequency
Parameter:	**15 Sag Threshold**
Function:	Power quality meter sag recording threshold.
Access:	Operator
Range:	0% to 399.99%
Unit	Percentage of parameter **13 Supply Voltage**
Default:	90%

Note:	This parameter adjusts the recording threshold for sag events recorded in the Event Log and on the Summary Page. It does not alter the operation of the PCS100 AVC-40.
Parameter:	**16 Surge Threshold**
Function:	Power quality meter surge recording threshold.
Access:	Operator
Range:	0% to 399.99%
Unit	Percentage of parameter **13 Supply Voltage**
Default:	110%
Note:	This parameter adjusts the recording threshold for surge events recorded in the Event Log and on the Summary Page. It does not alter the operation of the PCS100 AVC-40.

Table 8-3: Menu 1 System Electrical Parameters

8.3.4 Menu 2 Commissioning

2 Commissioning

The menu contains parameters for commissioning and testing

Note: This menu is only visible with Tech login

Parameter:	**20 Config Check Mode**
Function:	Provides a check of the phasing of the supply cables.
Access:	Tech
Range:	True / False
Setting Up:	When this parameter is set to True the output correction voltages will be V1-100%, V2-105% and V3-110% of the parameter **13 Supply Voltage** setting.
Note:	This check should be performed during commissioning. See document 2UCD074000E004 PCS100 AVC-40 Commissioning Checklist.
Parameter:	**21 Test Mode**
Function:	Selects test modes.
Access:	Tech
Range:	15 test options
Default:	NONE
Parameter:	**22 Test Voltage**
Function:	Selects output voltage under Test Mode.
Access:	Tech
Range:	-4.0000 to 3.9999
Units	PU. Base = **13 Supply Voltage**
Default:	0.0000
Parameter:	**23 Test Frequency**
Function:	Selects output frequency under Test Mode.
Access:	Tech
Range:	-200.00 to 199.994
Units	Hz
Default:	Nameplate rating of PCS100 AVC-40
Parameter:	**24 Relay Test Mode**
Function:	Turns relays on and off.
Access:	Tech

Range:	7 test options
Default:	off
Parameter:	**25 RMS Line Gnd Test**
Function:	Changes status page voltage readings from L-L to L-G
Access:	Tech
Range:	True / False
Default:	False
Note:	For calibration of voltage sensors
Parameter:	**26 GDM Remote Menus**
Function:	Enables remote access to the GDM menus via the GDM Ethernet connection
Access:	Tech
Range:	True / False
Default:	False
Note:	If enabled, allows an operator to remotely configure the PCS100 AVC-40.
Parameter:	**27 Auto Start**
Function:	Allow the system to assume it's previous run state after system power is lost.
Access:	Tech
Range:	No Auto Start = Do not auto start Mem Auto Start = Auto start in the same state as when the PCS100 AVC-40 was powered down Always Auto Start (Recommended)
Default:	No Auto Start

Table 8-4: Menu 2 Commissioning Parameters

8.3.5 Menu 3 Product Revision

3 Product Revision

The menu contains displays various PCS100 AVC-40 software numbers and revisions

Parameter:	**30 System Product**
Function:	Displays the product's main software number.
Note:	For PCS100 AVC-40 this is "7300"
Parameter:	**31 System Revision**
Function:	Displays the main system software revision.
Note:	Products relating to this manual should be R2E1 revision or later.
Parameter:	**32 SCM Boot Product**
Function:	Displays the SCM (System configuration manager) boot software name.
Note:	The PCS100 AVC-40 SCM Boot SW is "7605-010"
Parameter:	**33 SCM Boot Revision**
Function:	Displays the SCM (System configuration manager) boot software revision
Parameter:	**34 SCM Product**
Function:	Displays the SCM (System configuration manager) software number
Note:	The PCS100 AVC-40 SCM SW is "7600-810"
Parameter:	**35 SCM Revision**
Function:	Displays the SCM (System configuration manager) software revision

Parameter:	**36 CGI Revision**
Function:	Displays the CGI software revision
Parameter:	**37 Modbus Revision**
Function:	Displays the Modbus software revision
Parameter:	**38 NTP Revision**
Function:	Displays the NTP (Network Time Protocol) software revision
Parameter:	**39 Email Revision**
Function:	Displays the Email software revision

Table 8-5: Menu 3 Product Revision Parameters

8.3.6 Menu 6 References

8.3.6.1 Submenu 60 V Setpoint

60 V Setpoint

The submenu contains parameters for configuring for the output voltage setpoint

Note: This menu is only visible with Tech login

Parameter:	**600 V Set Manual**
Function:	Sets the target output voltage of PCS100 AVC-40
Access	Tech
Range:	± 10% of parameter **13 Supply Voltage**
Units:	Volts
Default:	Nameplate rating of PCS100 AVC-40
Setting Up:	Set to nominal supply voltage ± 10% (RMS)
Note:	Typically, this parameter is set to the same value as **13 Supply Voltage**. If set too close to **15 Sag Threshold** or **16 Surge Threshold** spurious sag/surge events may be recorded in the event log.
Parameter:	**601 V Set Source**
Function:	Sets the source of output voltage setting
Access	Tech
Range	Manual / AIN1 / AIN2 / Modbus
Default setting:	MANUAL
Setting Up:	For settings other than Manual the CAN I/O board is required.
Note:	For an AVC without a CAN I/O board only manual adjustment of the AVC output voltage is available.

Table 8-6: Menu 6 Reference Parameters

Note:
Additional parameters in this submenu are related to optional CAN I/O board and are not used with standard PCS100 AVC-40 operation and thereby not described in this document. Complete parameter descriptions are shown in a separate document related to CAN I/O board.

8.3.7 Menu 7 GDM Services

7 GDM Services	
The menu contains the status of various GDM services	
Note: This menu is only visible with Operator or Tech login	
Parameter:	**71 Webserver Status**
Function:	Displays the status of the webserver.
Access	Operator
Range:	Should display “Running”
Note:	This parameter is not displayed if the webserver service is not available.
Parameter:	**72 Vcanserver Status**
Function:	Displays the status of the Vcanserver.
Access	Operator
Range:	Should display “Running”
Note:	Vcanserver is the software module interfacing the CAN bus used by the PCS100 AVC-40 master controller to the webserver in the GDM.
Parameter:	**73 Modbus Service**
Function:	Displays the status of the Modbus TCP Service
Access	Operator
Parameter:	**74 NTP Status**
Function:	Displays the status of the NTP (Network Time Protocol) client service.
Access	Operator
Range:	“Running clock updated” if the NTP service is running, has retrieved the time from the NTP server and has updated the System time. “Invalid Server Name” if no NTP server IP address has been set. “Server connection failed” if no response from the NTP server was received. “Running” if the NTP service is running and has retrieved the time from the NTP server.
Note:	The NTP service will sync the system time to the NTP server time once every 30 minutes. Wait at least 30 seconds after setting the NTP server IP address parameter **75 NTP Server** before refreshing menu 7 GDM Services. The NTP Status field will be updated when entering the menu.
Parameter:	**75 NTP Server**
Function:	Sets the IP address of an NTP (Network Time Protocol) server.
Access	Tech
Range:	Any valid Ipv4 formatted IP address.
Setting Up:	Enter the IP address of the NTP server
Note:	Wait for at least 30 seconds before refreshing the 7 GDM Services menu to check parameter **74 NTP Status**.
Parameter:	**76 NTP Time Zone**
Function:	Sets the local time zone offset from UTC.
Access	Tech
Range:	±13 hours

Parameter:	**77 Email Service**
Function:	Sets up the email notification service of power quality and system events.
Access	Operator

Table 8-7: Menu 7 GDM Services Parameters

8.3.7.1 Submenu 73 Modbus Service

73 Modbus Service

The submenu contains parameters for configuring the Modbus status and write access.

Note: This menu is only visible with Operator or Tech login

Parameter:	**730 Modbus Status**
Function:	Displays the status of the Modbus TCP Service
Access	Operator
Range:	Should display “Running”
Note:	After a software upgrade the PCS100 AVC-40 needs to be rebooted twice to initialize the Modbus
Parameter:	**731 Date Write Enable**
Function:	Controls write access to the Modbus date/time register id 100
Access	Tech
Range:	True or False. Default is False
Note:	To allow Modbus to write to the system time this needs to be set to true
Parameter:	**732 Control Write Enable**
Function:	Control write access to the Modbus registers run id 1002, stop id 1004 and reset id 1000 and the AC voltage setpoint id 1006
Access	Tech
Range:	True or False. Default is False

8.3.7.2 Submenu 77 Email Service

77 Email Service

The submenu contains parameters for configuring for the email notification service for power quality and system events.

Note: This menu is only visible with Operator or Tech login

Parameter:	**770 SMTP Server**
Function:	Sets the IP address of an SMTP server.
Access	Operator
Range:	Any valid IPv4 formatted IP address.
Setting Up:	Enter the IP address of the SMTP server.
Parameter:	**771 Email Status**
Function:	Displays the running status of the Email Notification Service
Access	Operator
Status	**Running** – The service is running correctly. **Stopped** – The service is installed but is not enabled. **Empty status/blank string** – The service is not installed.
Parameter:	**772 Status_Log**
Function:	This can be used for troubleshooting problems that may arise while configuring the Email Notification Service.
Status	**Info:** A low-level information-only status event. **Notice:** An important status event key to the operation of the service. **Error:** This indicates an important failure that should not normally occur.
Access	Operator
Parameter:	**773 From Address**
Function:	Sets the Email address to send power quality and system event notifications to customer.
Access	Operator
Setting Up:	Any valid email address that the email server will accept.
Parameter:	**774 Customer_note_1**
Function:	Allows operator to enter notes as required.
Access	Operator
Parameter:	**775 Customer_note_2**
Function:	Allows operator to enter notes as required.
Access	Operator
Parameter	**778 PQ_Event**
Function:	Allows operator to configure and test the PQ event email notifications.
Setting Up:	**7780 Email Address:** Destination email address for the PQ event email notification to be sent to.
	7782 Force Email: Allows users to test the PQ event email notification service when set to true. An email will be sent out using the email server settings and the email address entered in **7780.** Allow up to a couple minutes for the email to be sent.
	7783 Enable: When set to true, this enables PQ event email notifications to be sent to the operator.
Parameter	**779 System_Event**
Function:	Allows operator to configure and test the System event email notifications.

Setting Up:	**7790 Email Address:** Destination email address for the system event email notification to be sent to.
	7791 Trigger Type: Gives the operator the option to choose the event that will trigger an email. The options include: – Trigger notification on Fault, – Trigger notification on Warning and – Trigger notification on Power Quality.
	7792 Force Email: Allows users to test the System event email notification service when set to true. An email will be sent out using the email server settings and the email address entered in **7790.** Allow up to a couple minutes for the email to be sent.
	7793 Enable: When set to true, this enables PQ event email notifications to be sent to the operator.
Parameter	**77A Service Log**
Function	Create a service log email that is sent out on the 1st of every month. This is set up in the factory.

8.3.8 Menu Graphic display

8.3.8.1 Submenu A00 Display

A00 Display

The menu contains parameters to set up the graphic display module

Name:	**A31 GDM Control Enable**
Function:	Enables or disables the local Start, Stop, Reset control.
Range:	True / False
Factory Setting:	True
Access:	Operator
Name:	**A62 Screen Saver Time**
Function:	Sets the time for the screen saver to activate.
Range:	0 min to 999 min
Factory Setting:	15 min
Access:	Operator
Name:	**A63 SSH Port Enable**
Function:	Enables SSH access.
Range:	True / False
Factory Setting:	False
Access:	Operator
Name:	**A64 Firmware Upload Enable**
Function:	Enables firmware uploads
Range:	True / False
Factory Setting:	False
Access:	Operator

Table 8-8: Submenu A00 Display Parameters

8.3.8.2 Submenu B00 Network Settings

B00 Network Settings

This menu contains parameters to set up the GDM Ethernet port.

Name:	**B11 Dynamic IP DHCP**
Function:	Configures the Dynamic Host Configuration Protocol (DHCP). This is displayed on the Product Page.
Range:	True = Dynamic. False = Static.
Access:	Operator
Setting Up:	The network may be configured using either static or dynamic configuration methods. The static method is the simplest for a direct connection to a PC. The IP address for the GDM is manually configured via parameter **B12 Static IP address**. The PC IP address in Windows may also need adjusting. The Dynamic method is when the computer's IP address is assigned automatically, in which case parameters **B12 Static IP address** and **B13 Static IP mask** do not need to be entered. Dynamic IP addresses are most frequently assigned on LANs and broadband networks by a Dynamic Host Configuration Protocol (DHCP) server. On any but the simplest network the network administrator's assistance will probably be required. Parameter **B15 Apply Settings** must be set to TRUE to save this setting.
Name:	**B12 Static IP address**
Function:	Configures the GDM Static IP address.
Range:	###.###.###.### (where ### = 1 to 255)
Access:	Operator
Setting Up:	Parameter **B15 Apply Settings** must be set to TRUE to save this setting. See section 10.2 for further setting up instructions.
Name:	**B13 Static IP mask**
Function:	Configures the GDM Static IP mask.
Range:	###.###.###.### (where ### = 1 to 255)
Access:	Operator
Setting Up:	Parameter **B15 Apply Settings** must be set to TRUE to save this setting. See section 10.2 for further setting up instructions.
Name:	**B14 Static IP gateway**
Function:	Configures the GDM Static IP gateway.
Range:	###.###.###.### (where ### = 1 to 255)
Access:	Operator
Setting Up:	Parameter **B15 Apply Settings** must be set to TRUE to save this setting. See section 10.2 for further setting up instructions.
Name:	**B15 Apply Settings**
Function:	Apply the network settings **B11 Dynamic IP DHCP**, **B12 Static IP address**, **B13 Static IP mask** and **B14 Static IP gateway**. Select True to update the configuration.
Range:	True / False
Access:	Operator
Setting Up:	To view the actual settings currently used by the PCS100 AVC-40 see the Product Page in section 6.1.5. See section 10.2 for further setting up instructions.

Table 8-9: Submenu B00 Network Settings

8.3.8.3 Submenu C00 Network Status

C00 Network Status	
This menu displays the network status for the GDM	
Name:	**C11 Actual DHCP active**
Function:	Displays the status of actual DHCP.
Range:	True / False
Access:	Read Only
Note	Useful for debugging network connection problems.
Name:	**C12 Actual IP address**
Function:	Displays the actual IP address.
Range:	###.###.###.### (where ### = 1 to 255)
Access:	Read Only
Note	Useful for debugging network connection problems.
Name:	**C13 Actual IP mask**
Function:	Displays the actual IP mask.
Range:	###.###.###.### (where ### = 1 to 255)
Access:	Read Only
Note	Useful for debugging network connection problems.
Name:	**C14 Actual IP gateway**
Function:	Displays the actual IP gateway.
Range:	###.###.###.### (where ### = 1 to 255)
Access:	Read Only
Note	Useful for debugging network connection problems.
Name:	**C15 MAC address**
Function:	Displays the product's MAC address.
Range:	##:##:##:##:##:##
Access:	Read Only
Note	Useful for debugging network connection problems.
Name:	**C15 Ethernet status**
Function:	Displays the status of Ethernet connection.
Range:	"Up" when active
Access:	Read Only
Note	Useful for debugging network connection problems.

Table 8-10: Submenu C00 Network Status

8.3.8.4 Submenu D00 Product Revisions

D00 Product Revisions

This menu displays the various software revisions for the GDM

Name:	**D00 Product Revision**
Function:	Product & revision information about the GDM.
Range:	D11 GDMIB Boot Product D12 GDMIB Boot Revision D13 GDMIB Product D14 GDMIB Revision D21 GDM Revision D31 Vcanserver name (should be “main_vcan_server”) D32 Vcanserver revision.
Access:	Read Only

Table 8-11: Submenu D00 Product Revision

9 EVENT CODES AND DESCRIPTIONS

Events, warnings and faults for the PCS100 AVC-40 are indicated via the GDM and recorded in the event log. A Summary of all the events, warnings and faults are shown in Table 9-2. If the recommended action does not remedy the warning or fault, then contact ABB for assistance. When contacting ABB, a copy of the downloaded event log or service log will typically be required.

NOTICE – Trained Operators
All operations on the PCS100 AVC-40 must only be carried out by a trained operator familiar with the contents of this manual. Hazardous conditions could arise from incorrect adjustment.

Abbreviation	Description
F	Fault. A fault has occurred and the PCS100 AVC-40 is in Bypass. The PCS100 AVC-40 cannot be started until the fault is removed.
AB	Auto Bypass. The PCS100 AVC-40 has automatically gone into Auto Bypass to protect itself. When the condition has ended, it will return to Run.
W	Warning. The PCS100 AVC-40 is functioning normally but a warning condition exists.
M	The fault originated in the master module.
R	The fault originated in a rectifier module.
I	The fault originated in an inverter module.

Table 9-1: Key for abbreviations in Table 9-2

Code	Origin	Type	GDM Info	Description	Recommended Action
1	M, R, I	F	Module Start Failure	The module failed to start because of an error with one of the following: (1) NVRAM (2) FPGA (Field Programmable Gate Array) (3) Configuration ID.	Power down and restart.
2	R, I	F	Desat	The fault may be caused by one of the following: The Inverter's IGBT (Insulated Gate Bipolar Transistor) is faulty; The Inverter's IGBT is overloaded; The IGBT driver's PCB (Printed Circuit Board) is faulty.	Power down and restart. If the fault is not resolved contact your ABB Service Agent to have the relevant module replaced.
3	R, I	F	Desat Cooling Time	A Reset was attempted too soon.	Wait for 15 min before pressing Reset.
4	M, R, I	AB	LVDC PSU Voltage Low	One of the following scenarios has occurred: - The control power supply has failed, or - The auxiliary module is faulty.	Check the AC supply voltage is correct. If the warning is not resolved, contact your ABB Service Agent to have the auxiliary module replaced.
5	R, I	F	Interlock Error	Two of the IGBTs (Insulated Gate Bipolar Transistor) from the same bridge are activated. Note: Only one should activate at any one time.	Replace the faulty module.
6	M, R, I	F	SPI Watchdog Error	There is an SPI (Serial Peripheral Interface Bus) watchdog error.	Ensure all communication cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.
7	M, R, I	F	Combined FPGA Fault	There is a generic FPGA (Field-Programmable Gate Array) fault.	Check all communication cables.
8	R, I	F	DC Bus Overvoltage	The DC Bus has risen to an unsustainable voltage because of one of the following scenarios: - The utility supply voltage is too high - There is excessive load regeneration	Check the utility supply voltage Review the load types.
9	R, I	W	DC Bus Voltage High	The DC Bus voltage is high. There may be an earth fault in the supply or excessive load regeneration.	Wait until the DC voltage has returned to normal. If the warning is not resolved, contact your ABB Service Agent.

Code	Origin	Type	GDM Info	Description	Recommended Action
10	R, I	W	DC Bus Voltage Low	DC Bus Voltage Low.	No action required. The PCS100 AVC-40 will automatically recover when the input voltage returns to normal.
11	R, I	AB	DC Bus Undervoltage	DC Bus Undervoltage.	No action required. The PCS100 AVC-40 will automatically recover when the input voltage returns to normal.
12	R, I	F	Zero Seq Current High	Inverter module zero sequence current is too high.	Contact your ABB Service Agent to have the fault resolved.
13	R, I	F	Zero Seq Abs Current High	The PCS100 modules absolute zero sequence currents are too high.	Contact your ABB Service Agent to have the fault resolved.
14	R, I	F	Sync Lost Failure	The inverter and/or rectifier lost synchronization with the master.	Check all communication cables.
15	R, I	F	Sync Lock T/O	The inverter and/or rectifier cannot synchronize with the master within the timeout period.	Ensure all communication cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.
18	M, R, I	W	Control Loop Timing	Sustainable internal condition. Control Loop processing result late.	Press Reset. If the warning is not resolved, power down and restart.
19	M, R, I	F	Internal Error	There was an internal error.	Press Reset. If the fault is not resolved, power down and restart.
20	M, R, I	W	Stack Level Warning	DSP stack has reached 75% threshold level.	Power down and restart. Notify your ABB Service Agent.
21	R, I	F	Contactor Activate T/O	The pre-charge or bypass contactor has not opened within the required time-out period.	Replace the faulty module.
22	R, I	F	Contactor Deactivate T/O	The pre-charge or bypass contactor has not de-activated (auxiliary contact detection) within the required time-out period.	Replace the faulty module.
23	R	F	Pre-charge Timeout	Pre-charge relay & soft-charge resistor are enabled for too long.	Replace the faulty module.
24	R	F	Soft-charge Error	Errors indicated by the soft-charge manager.	Replace the faulty module.
25	R	AB	Softcharge Timeout	The soft-charge sequence takes too long, causing restart sequence.	Replace the faulty module.
26	R	W	DC Bus Ripple High	DC Bus ripple voltage high.	Check all three phases are present.

Code	Origin	Type	GDM Info	Description	Recommended Action
27	M, R	AB	PLL Unlocked	The phase lock loop is not locked to the input voltage. This usually occurs when the supply to the Rectifier is switched off.	Check the utility supply. If the warning is not resolved, contact your ABB Service Agent to have the utility and load voltage sense connection checked.
28	R	AB	Control Model Unstable	Model control loop parameters out of range.	Replace the faulty module.
29	R, I	F	Contactor Recharge Error	Second contactor activation before recharge delay has timed out.	Contact your ABB Service Agent to have the fault resolved.
30	R	F	Bus Not Charging	Soft-charge error if the DCV < 0.15 PU after 200 ms, bus not charging.	Contact your ABB Service Agent to have the fault resolved.
31	M, R, I	F	FPGA Reset	Either the FPGA (Field-Programmable Gate Array): - has not been reset, or - did not initialize.	Press Reset. If the fault is not resolved, power down and restart.
32	I	F	Bypass Error	Errors indicated by bypass manager.	Contact your ABB Service Agent to have the fault resolved.
33	I	F	Bypass Contactor Forced	Bypass SCRs enabled too long before bypass contactor, detected in hardware and contactor forced closed.	Replace the faulty module.
34	I	F	SCR On Timeout	Bypass SCRs on too long when contactor remains open (in AUTO BYPASS mode).	Replace the faulty module.
35	I	F	SCR Not Off Timeout	Bypass SCRs remain on too long (not turned off) after contactor opened from STOP to RUN transition.	Replace the faulty module.
36	I	F	Bypass Open Error	With bypass open the current in inverter and bypass CT’s are not the same.	Contact your ABB Service Agent to have the fault resolved.
37	I	F	Bypass Close Error	With bypass closed, the inverter CT still carries current.	Contact your ABB Service Agent to have the fault resolved.
38	I	W	Out of Regulation Warning	One of the inverter three phase output RMS voltages differs from their reference values by more than 10%.	No action required.
39	I	F	Out of Regulation Error	One of the inverter three phase output RMS voltages differs from their reference values by more than 25%.	Check voltage sensing circuits including master DB9 cables. Replace Inverter module.

Code	Origin	Type	GDM Info	Description	Recommended Action
40	I	F	SDI Cmd Error	The Streaming Data Interface error count is too high.	Contact your ABB Service Agent to have the fault resolved.
41	I	F	SDI Mode Error	Non-recoverable internal fault.	Contact your ABB Service Agent to have the fault resolved.
42	M	F	Initialisation Failure	A setting is out of range.	Contact your ABB Service Agent to have the fault resolved.
43	M	F	Fault Reset Timeout	The master was not able to reset a fault in an inverter or rectifier module.	Ensure all communication cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced. If there is no damage and the fault is not resolved, power down and restart.
44	M	F	Parameter Error Downstream	The master could not access a setting from within the inverter or rectifier.	Ensure all communication cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced. If there is no damage and the fault is not resolved, power down and restart.
45	M	F	Unexpected Bypass	Bypass activated for unknown reason. Bypass activation not reported to the master.	Contact your ABB Service Agent to have the fault resolved.
46	M	W	Inverter Unbalanced	There is a variation in current level between inverter modules above threshold.	Check all inverters are operating.
47	M	F	DC Bus Unequal	Difference in DC Bus voltages between rectifier and inverter is above threshold.	Contact your ABB Service Agent to have the fault resolved.
48	R	AB	DC Bus Uncontrolled	DC Bus undervoltage – lower than U_{RMS}*sqrt (2) *correction – the control loop does not have enough headroom to control inductor voltages.	Check the incoming AC voltage is not too high.
49	R, I	W	HW Current High	The short duration transistor current is too high. Note: The limit is set by the hardware.	Reduce the load's current to maintain full protection.

Code	Origin	Type	GDM Info	Description	Recommended Action
50	R, I	AB/F	HW Overcurrent	The long-duration transistor current is too high. This may be caused by a short circuit in the load. Note: The limit is set by the hardware.	Investigate the load for short circuits.
51	R, I	W	Current Limit	The inverter's (or rectifier's) current exceeds 110% of its rating.	Reduce the load's current to maintain full protection.
52	I	W	Bypass Current High	Bypass Current High.	No action required.
53	M	AB	System HW Overcurrent	The load's current exceeds the rating of Inverter. There may be short term transient over currents. Note: The limit set by the hardware.	Ensure that the load is suitable.
54	M	AB	System Current High	The load current is near the limit. The limit is 160% of Inverter rating. Note: The limit is set by the software.	Reduce the load current to maintain full protection.
55	R, I	F	Sine Filter Over Temp	The PTC (Positive Temperature Coefficient thermistor) in module sine filter choke indicates temperature is too high.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
56	R, I	AB	Heatsink Hot	The inverter's (or rectifier's) heat sink is too hot. Note: A sensor is mounted on the heat sink.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
57	R, I	F	Heatsink Over Temp	The inverter's (or rectifier's) heat sink is too hot. Note: A sensor is mounted on the heat sink.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
58	R, I	AB	Enclosure Hot	The inverter (or rectifier's) enclosure's internal temperature is too hot (near limit). Note: The temperature is monitored by a thermistor in enclosure.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
59	R, I	F	Enclosure Over Temp	The inverter (or rectifier's) enclosure's internal temperature is too hot (over the limit). Note: The temperature is monitored by a thermistor in enclosure.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
60	R, I	AB	Transistor Case Hot	The inverter's (or rectifier's) IGBT (Insulated Gate Bipolar Transistor) case temp is too hot (near limit). Note: The temperature is calculated using a thermal model.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.

Code	Origin	Type	GDM Info	Description	Recommended Action
61	R, I	F	Transistor Case OverTemp	The inverter's (or rectifier's) IGBT (Insulated Gate Bipolar Transistor) case temperature is too hot (over the limit). Note: The temperature is calculated using a thermal model	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
62	R, I	W/AB	Transistor Junction Hot	The IGBT junction is too hot (near limit). Note: The temperature is calculated using a thermal model.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
63	M, R, I	W/AB	Copper Hot	The choke winding is too hot (near limit). Note: The temperature is calculated using a thermal model.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
64	R, I	AB	Copper Over Temp	The choke winding is too hot. Note: The temperature is calculated using a thermal model.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
65	I	AB	Bypass Over Temp	Long duration bypass over temperature detected.	None
66	M	W	Transformer Hot	Transformer is too hot. Note: The temperature is detected by a thermistor in transformer winding.	Ensure all module fans are operating. Ensure the ambient temperature is not too high.
67	M, R, I	W	VCAN Warning	There is sustainable interference in the module communications cables.	Ensure all communication ribbon cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.
68	M, R, I	F	VCAN Error	There was a non-recoverable communications error between the master and the inverter.	Ensure all communication ribbon cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.
69	M	F	Rectifier Lost	The Master controller lost communications with rectifier module.	- Check ribbon cables between modules - If damaged, contact your ABB Service Agent to have the cables replaced.
70	M	F	Inverter Lost	The Master controller lost communication with the inverter module.	Ensure all communication ribbon cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.

Code	Origin	Type	GDM Info	Description	Recommended Action
71	R, I	F	Master Lost	The rectifier or inverter lost communication with master module.	Ensure all communication ribbon cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.
72	R, I	W	Module Comms Warning	Two consecutive frames have been lost from the Streaming Data Interface.	Ensure all communication ribbon cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.
73	R, I	F	Module Comms Fault	The Streaming Data Interface frame loss exceeds the threshold.	Ensure all communication ribbon cables are connected and not damaged. If damaged, contact your ABB Service Agent to have the cables replaced.
75	M	F	PC Comms Lost	Master lost communication with critical TCPM (PC).	Check the PC connections.
76	M	F	GDM Lost	Master lost communication with critical GDM.	Check the GDM connections.
77	R, I	W	Module Address Changed	A module has been replaced. The replacement's number was not recognized.	If a module has been replaced check the module ID number is set to the same as the replaced module.
78	M	F	Module Number Mismatch	Number of rectifier and inverter modules is unequal.	- Ensure module IDs are set correctly - If not, contact your ABB Service Agent to have the cables replaced.
79	R, I	W	Module Display Warning	There are sustainable communication errors between the module display board and module Digital Signal Processor Engine (DSPE).	Ensure the module display board is firmly plugged into the interface board.
80	R, I	F	Module Display Error	There were unsustainable communication errors between the module display board and the module DSPE (Digital Signal Processor Engine).	Ensure the module display board is plugged firmly into the interface board.
81	M, R	AB	Inverter AC Voltage Low	The input voltage is below the operation threshold. Note: This is normal when the input voltage is removed or applied.	Check utility voltage is within the thresholds.
82	R	AB	Utility Open Source	Utility open source detected. Input has been switched off.	Check the input breaker.

Code	Origin	Type	GDM Info	Description	Recommended Action
83	M	F	IOM Test mode	Commissioning test mode has been activated. Setting: 915 Relay Test Modes	When the test has been completed switch off the test mode
84	M, I	W	Negative Phase Rotation	Negative phase rotation detected. Correct the phase sequence.	Check the input phases are wired to the correct input terminal.
85	M	F	Output Voltage High	Output over-voltage detected.	None
86	M, R, I	F	Not Passed Tester	This fault occurs when a module has: - not passed the factory test, or - failed since leaving the factory.	Contact your ABB Service Agent to have the faulty module replaced.
87	M, R, I	F	IRQ Frequency Error	Software task IRQ not occurring at correct frequency.	Replace the module.
88	M	F	Serial Number Error	The system (product) serial number in SCM and master DSPE are different.	Replace the whole master auxiliary module as a complete unit.
89	M	AB	Utility or Load Voltage Error	Utility and load RMS voltages differ by more than the maximum correction ratio indicating error.	Repair the sensors.
90	R, I	AB	Heatsink Cold	Rectifier or inverter heatsink sensor error or ambient temperature too cold.	Replace faulty rectifier or inverter module. Check the ambient temperature.
91	R, I	AB	Enclosure Cold	Rectifier or inverter enclosure sensor error or too cold.	Repair the sensors if broken.
108	R	F	RFI Lead Misconfiguration	The RFI configuration in the power modules does not match the Master map.	Check the part numbers of the power modules are correct for this machine.
109	R, I	F	Protection Message Error	Protection Message Error.	Check cables.
142	M	W	Output short circuit	Module output short circuited.	Check system for shorts.
167	M	W	CIOB Lost	Master lost communication with CAN I/O board (CIOB).	Check connections and fix faulty CIOB if necessary.
168	M	F	CIOB Module Error	CIOB has an internal error preventing it from running.	Remove commissioning mode or fix faulty CIOB
169	M	W	CIOB Analog IP Overrange	CIOB Analog input signal is overrange (5%).	Select correct mode or setup source for the CIOB inputs correctly
170	M	F	CIOB PTC Overtemp	CIOB external PTC overtemperature.	Correct the source of the trigger in the external system
192	M	W	External Transformer	External transformer warning input active	Repair the source of the external transformer warning

Code	Origin	Type	GDM Info	Description	Recommended Action
194	System	Info	Byp Open Retires Exceeded	The system has tried to open the contactor too many times	Info only
195	M	W	CIOB RS485 Timeout	CIOB RS485 Communication timeout (Modbus).	Repair external RS485 device
202	R, I	W/AB	Transistor Junction OverTemp	Rectifier or inverter transistor junction model hot.	Check all module fans are operating properly, and ambient temperature is not too high.
209	System	Info	Reboot	The system is rebooting, perhaps after a firmware upgrade.	Info only
210	System	Info	Remote	A Start, Stop or Reset command has been received from remote terminal.	No action required
211	System	Info	Local	A Start, Stop or Reset command has been received from the GDM.	Info only
212	System	Info	Automatic	The system has received an Automatic Stop command. Note: This typically occurs after a reset.	Info only
214	System	Info	CanIO	A Mode change command has been received by master mux I/O lines	Info only
216	System	Info	Modbus	A Mode change command has been received by a Modbus connected device	Info only
217	System	Info	Factory webpage	A Mode change command has been received by the internal factory web pages	Info only
218	System	Info	Remote webpage	A Mode change command has been received by the remote user web pages	info only
219	System	Info	Command Line	A Mode change command has been received from the command line	info only
220	System	Info	Unknown source	A Mode change command has been received from an unknown source.	Info only
276	R	F	RFI relay error	RFI relay or driver indicated a problem.	Power cycle system and if problems persist contact ABB service.
283	R	F	Many contactor activations	The soft charge contactor is switching too often.	Replace module.

Code	Origin	Type	GDM Info	Description	Recommended Action
328	M	W	SCM Comms lost	The Master has failed to receive a response to a status request from the SCM.	(1) Check the event log for SCM errors. (2) Check the power supply to the SCM. (3) Check VCAN cables and connections between the Master and the SCM.
331	M	W	SCM fault	The System configuration manager (SCM) has detected a fault in the SCM or the System.	See document 2UCD200000E430 PCS100 SCM Diagnostics.
332	M	W	Master Reset	The Master has performed a software reset.	Info only. Caused by a software lock up or system reboot.
404	R, I	F	IGBT Gate drive Failure	IGBT desaturation detected without the IGBT being switched.	Power down and restart. If the fault is not resolved contact your ABB Service Agent to have the relevant module replaced.

Table 9-2: PCS100 AVC-40 Event codes and descriptions.

10 REMOTE MONITORING

The PCS100 AVC-40 provides remote access for monitoring purposes. Following monitoring connections are available:

- Integrated Web server. Using the integrated web server, the same information as displayed on the GDM is available on any networked PC connected to the PCS100 AVC-40. In addition, downloading event and service information is possible from the integrated web server.
- Modbus TCP. For connection to plant wide SCADA or monitoring systems the PCS100 AVC-40 has a list of registers that can be accessed.
- Email Connectivity. An email notification service can be set up to send notifications of power quality and system events.
-

Communication Type	Description	Port	Connection
Remote Web Pages	Webserver via HTTP, Ethernet	80	Standard RJ45
	SW upgrade via SSH	22	Standard RJ45
Monitoring system	Modbus TCP	502	Standard RJ45
Remote notifications	E-mail		Standard RJ45

Remote Web Pages

Remote Web Pages are a set of web pages that are similar in format to the standard GDM and accessed through the integrated web server via the GDM Ethernet connection. Through this interface the users can remotely access the status and operating parameters. Viewing and downloading of event history and service logs is also available. Access is via the Ethernet port of the GDM, and web pages can be viewed with any standard web browser on a device connected to the same network.

Note: for security reasons Start/Stop control and parameter menus are disabled by default. However, they can be enabled through parameter settings on the unit.

Modbus TCP

Modbus TCP connection is also provided via the Ethernet port of the GDM user interface.

Read Only access is available to operating parameters such as voltages, currents and power levels.

E-mail

PCS100 AVC-40 is configurable for sending e-mail notifications in case of power quality event or system's internal event as faults and warnings.

Automatic sending of the service logs via e-mail to ABB Service can also be enabled.

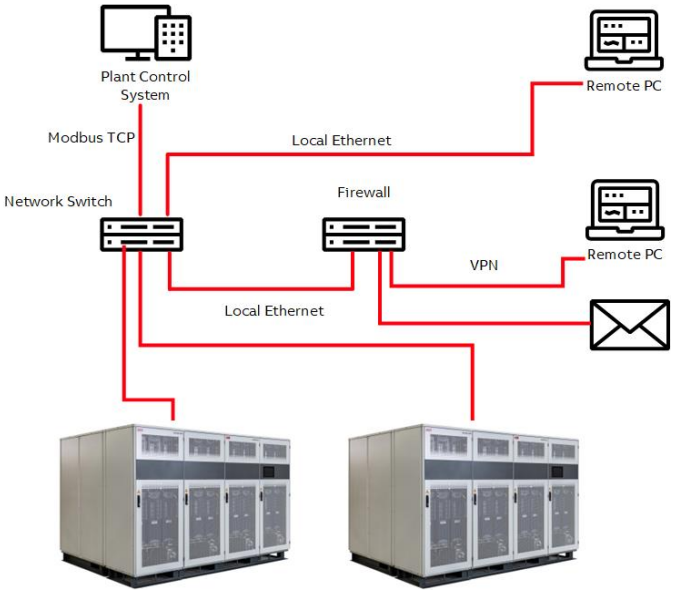


Figure 10-1: PCS100 AVC-40 remote monitoring diagram

10.1 Cybersecurity

10.1.1 Cybersecurity Disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

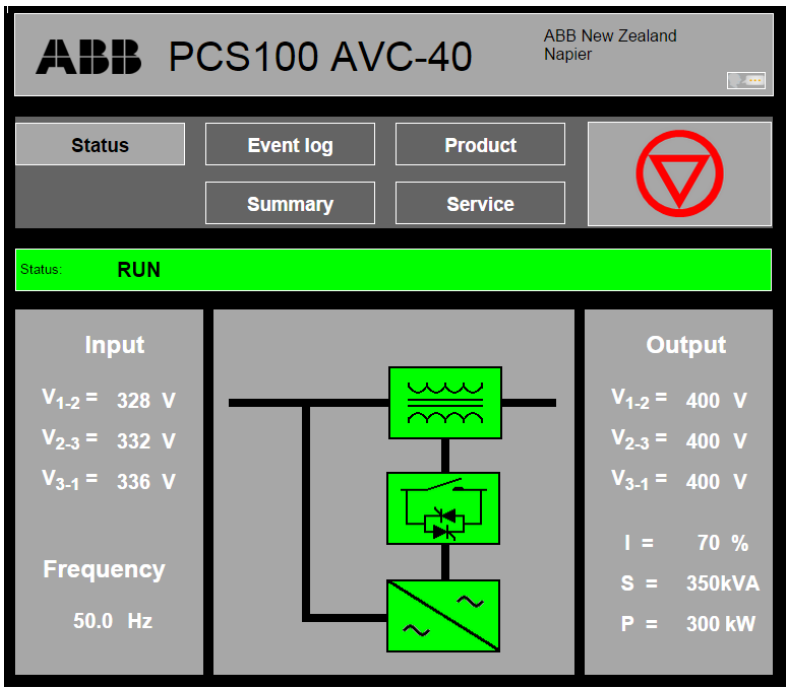
10.1.2 List of User/System accounts in ABB delivery

Linux root account is only available as a service account used with SSH. SSH port is disabled by default, however, it can be enabled through parameter settings.

10.2 Remote Web Pages

The Graphical Display Module contains a set of web pages that are similar in format to the standard GDM pages described in section 6.1. Graphic Display Module (GDM). They may be accessed via the Ethernet port of the GDM and viewed on a remote PC using any standard web browser.
The following pages are supported:

4. Status page
5. Event Log
6. Product page
7. Summary page
8. Service page
9. Menu page (if enabled via parameter **26 GDM Remote Menus**)



Each page contains the Navigation Panel, and the Status Bar, and each page is accessed by clicking the buttons using a mouse.

Start(I)/Stop(O)/Reset functionality is only supported through these pages if remote menu access is enabled via parameter **A31 GDM Control Enable**.

Figure 10-2: PCS100 AVC-40 Remote Web Pages Status Page

Note: The following pictures are examples and the values on the display do not represent all models.

10.2.1 Connecting the Network Connection.

To access the web pages, connect your PC to the Ethernet port on the bottom of the GDM using an Ethernet cable.

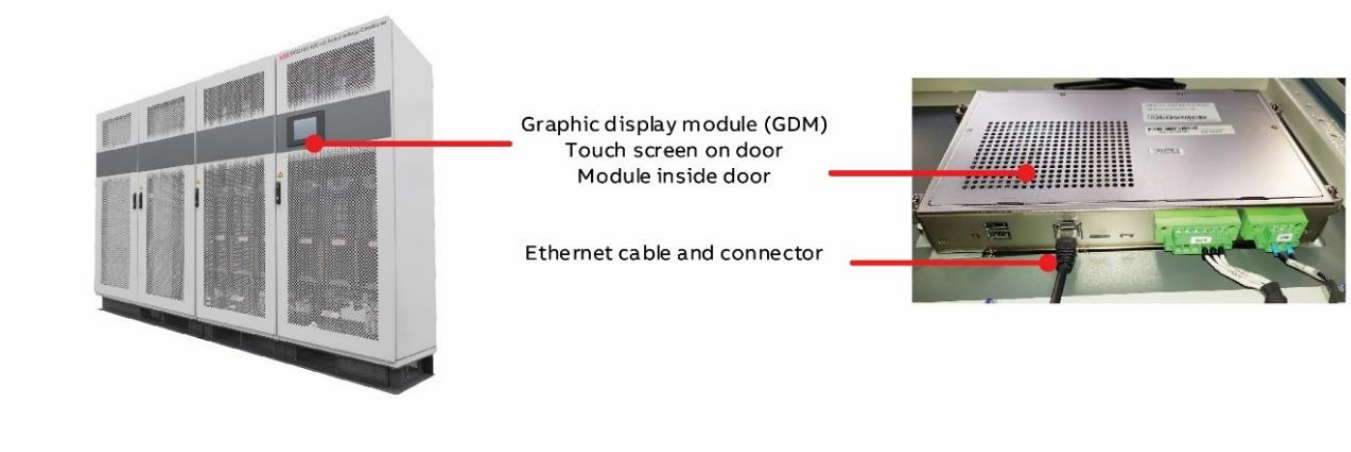


Figure 10-3: GDM Ethernet connector.

Connecting a GDM directly to a computer using an Ethernet cable.

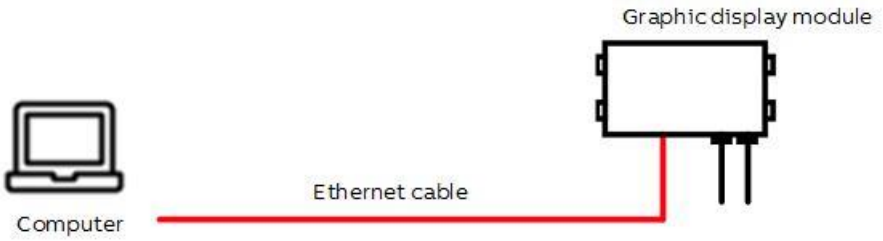


Figure 10-4: GDM Ethernet connection.

You can connect one or more PCS100 AVC-40 GDMs to a network using a Ethernet switch or hub and ethernet cables.

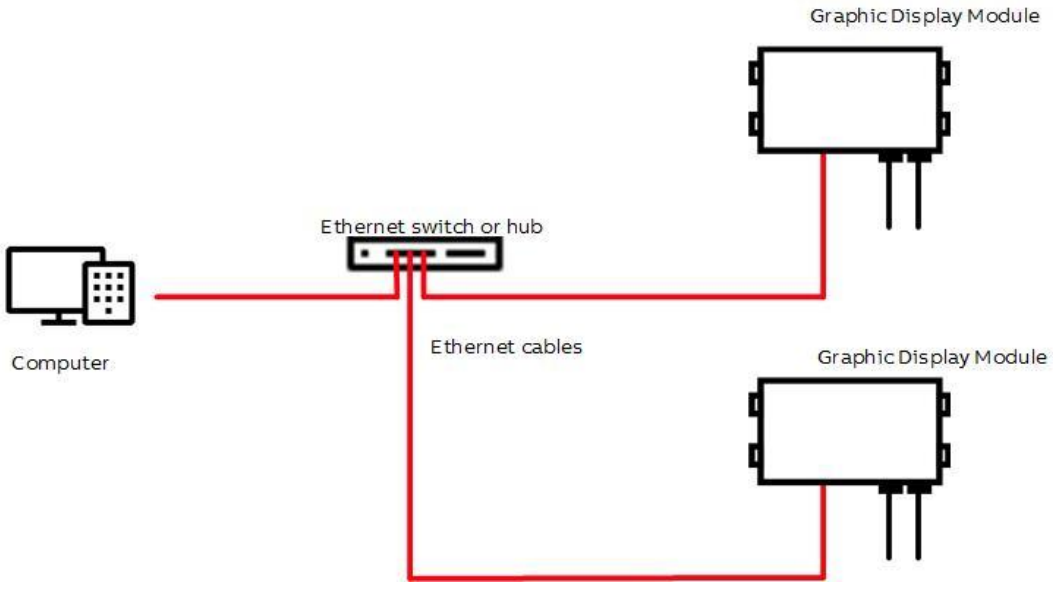


Figure 10-5: Multiple GDM connections.

10.2.2 Configuring the Network Connection.

The Ethernet network is configured using parameters **B11** to **B15**. See section 8.3.8.2. Submenu B00 Network Settings.

For a full description on how to configure the network connection see ABB document No. 2UCD20000E001 How to View the GDM Remote Web Pages.

10.2.3 Connecting to Remote Web Pages

Enter the GDM IP address (as configured in Submenu B00 Network Settings. See Section 8.3.8.2.) in the address field of your PC web browser. Use the format http://##.###.##.## where ##.###.##.## is the IP address of the GDM.

10.2.4 Remote Web Pages Language Selection

Remote Web Pages enable the users to select different language for each remote client. List of available languages is shown in Section 8.3.1. Menu Language.

To select Remote Web Pages language, click on the Languages button (Figure 10-6: Language) and select language from the listed languages in the Language Page (Figure 10-7).

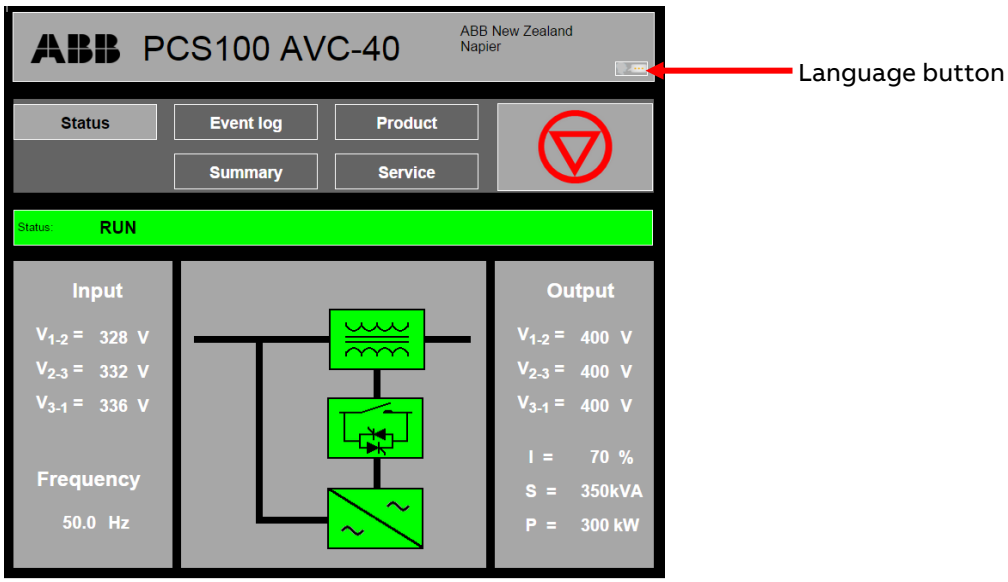


Figure 10-6: Language button.

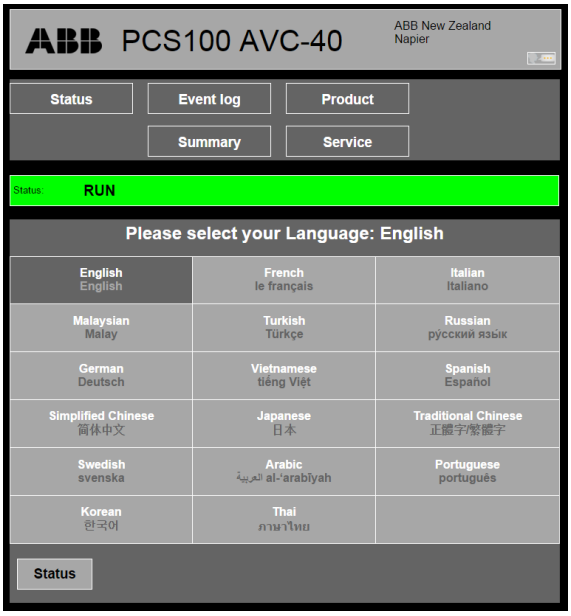


Figure 10-7: Languages Page

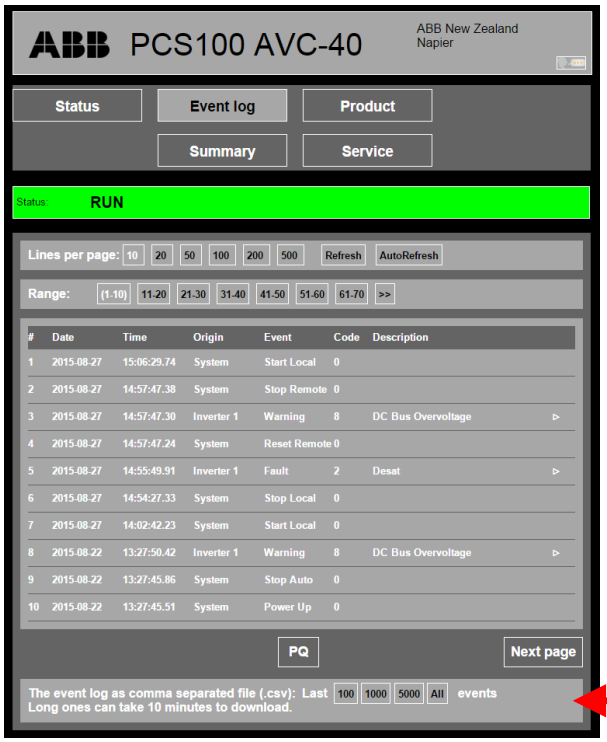
By pressing the selected language button, GDM language is instantly changed to the selected language. To return to the Menu Page press Menu button.

Note:
Change of language on Remote Web Pages does not change the unit's GDM language.

10.2.5 Viewing and Downloading the Event Log

Viewing and downloading of the event log is done by the Event Log Page.

Figure 10-8 shows a typical remote web pages event log. The number of lines per page and the range of events being view can be selected. Additionally, the user is able to download the event log. The last 100, 1000, 5000 or All events can be downloaded.



To download the event log to the connected PC, click the number of events.

Figure 10-8: PCS100 AVC-40 remote web pages event log

The downloaded event log is in .csv format and can be opened using Microsoft Excel. Each event is displayed on one line. See section 6.1.4.1 for a full description of the event log.

10.2.6 Service Page

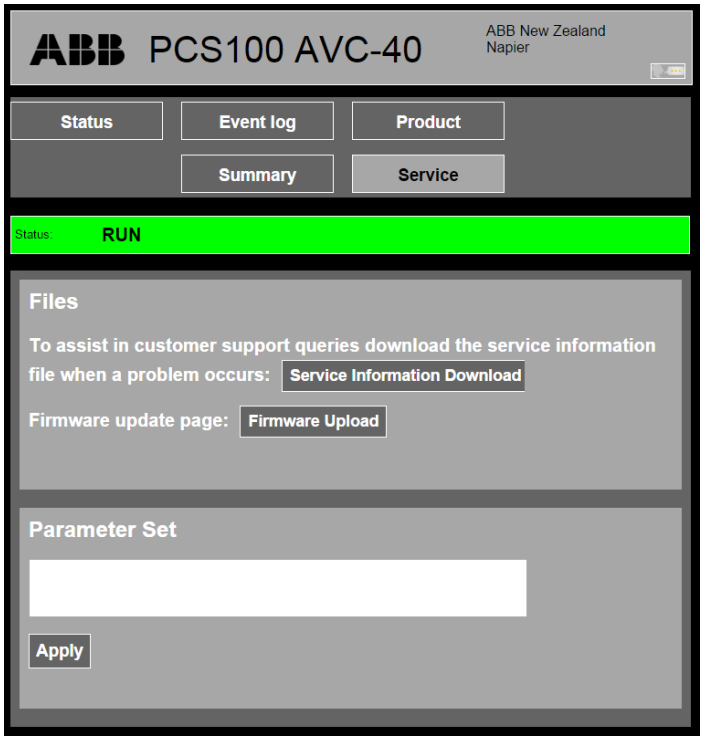


Figure 10-9: Remote Web Pages Service Page

The Service Page has following three functions.

10.2.6.1 Download Service Information.

Information useful for the ABB service department such as parameter settings and the event log can be downloaded. The information is contained within a zip file which can be sent to the ABB factory to assist in analyzing problems with the product. To download this information:

a. Click Service Information Download. You will be informed that a service file is being created. Creating a service file is a five-step process. This may take some time, e.g., five minutes. You will then be informed that the service information is ready to download.
b. When prompted by your browser, save the file to the relevant location on your device.

10.2.6.2 Update the Product Firmware

Click Firmware Upload, then click Browse and select the software file provided by the ABB factory. The name of the software file typically starts with a 4-digit number beginning with 7. Once the file has downloaded the system must be rebooted via parameter 051 System Reboot.
For further information on upgrading software over Ethernet see document 2UCD200000E002 How to Upgrade System Software over Ethernet.

10.2.6.3 Make a change to an internal parameter

Enter the factory supplied code to change the required internal parameter. When a correct code is entered the message “Parameter Write Result = OK” will be displayed. If an incorrect code is entered the message “Sorry, value entered is not correct” is displayed. This function is the same as parameter **08 Set Parameter**.

10.3 Modbus TCP

Modbus TCP connection is provided with PCS100 AVC-40's fitted with the GDM user interface. Connection is via an Ethernet cable to the Ethernet port on the bottom of the GDM. Read Only access is available to the parameters in Table 10-1: PCS100 AVC-40 Modbus TCP User Parameters.

Modbus protocol is an open messaging structure developed by Modicon in 1979, used to establish master-slave (client/server) communication between intelligent devices. It is a de facto standard, truly open and the most widely used network protocol in the industrial manufacturing environment.

Modbus TCP specification (available from www.modbus-ida.org/specs.php) was developed in 1999, combining the physical network (Ethernet) with a networking standard (TCP/IP) and a vendor neutral data representation (Modbus) giving an open, accessible network for exchange of process data.

Modbus TCP basically embeds a Modbus frame into a TCP/IP frame in a simple manner.

10.3.1 Supported Functions

The following Modbus functions are supported:

Function 3 – Read multiple registers
Function 4 – Read input registers
Function 8 – Diagnostic request

The Modbus server has the following characteristics:

Maximum registers per request	16
Maximum TCP connections	5
Modbus server port	502

Refer to section 10.2.2 for network configuration details. There are no additional Modbus TCP specific user parameters.

10.3.2 Performance

Each user parameter read for registers in Table 10-1 can take up to 300 ms due to the latency of the PCS100 internal communication bus. To improve Modbus client responsiveness (such as for use in SCADA systems), the Modbus TCP server caches a range of user parameters as specified in Table 10-2.

The Modbus TCP server responds to reads from the cached addresses in typically less than 3 milliseconds. However, the latency in a parameter changing value (the time it takes for the cached values to be refreshed) is typically around 3 seconds.

10.3.3 Modbus TCP User Parameters

The following table lists the user parameters available from the PCS100 AVC-40.
The address listed is the offset (raw) address. For 4xxxx address add 40001 to the offset address. Each address refers to a 16-bit register.

Address	Name	Access	Type	Raw Value & Scaling
1	Product Status	Read Only	16-bit, Enum	0 – FAULT 1 – BYPASS 2 – STARTING 3 – RUN 4 – STOPPING 5 – AUTO BYPASS
2	Warning Indication	Read Only	16-bit, Enum	0 – NOT WARNING 1 – WARNING
3	Inhibit Indication	Read Only	16-bit, Enum	0 – NOT INHIBIT 1 – INHIBIT
4	Rated Voltage	Read Only	16-bit, Signed	Voltage (line-to-line RMS volts) = raw value e.g., raw value = 480 Voltage = 480 V
5	Rated Frequency	Read Only	16-bit, Signed	Frequency (Hz) = raw value / 32 e.g., raw value = 1920 Frequency = 60 Hz
6	Rated Current	Read Only	16-bit, Signed	Current (RMS Amps) = raw value e.g., raw value = 500 Current = 500 A
7	Input Voltage V1-V2	Read Only	16-bit, Signed	Voltage (line-to-line RMS volts) = raw value x **13 Supply Voltage** / 8192 e.g., raw value = 7782 rated voltage = 480 V Voltage = 456 V Voltage (% of rated voltage) = raw value x 100 / 8192 e.g., raw value = 8192 Voltage = 100%
8	Input Voltage V2-V3	Read Only	16-bit, Signed	
9	Input Voltage V3-V1	Read Only	16-bit, Signed	
10	Output Voltage V1-V2	Read Only	16-bit, Signed	
11	Output Voltage V2-V3	Read Only	16-bit, Signed	
12	Output Voltage V3-V1	Read Only	16-bit, Signed	
13	Load Current I1	Read Only	16-bit, Signed	Current (RMS Amps) = raw value x **10 System Current** / 8192 e.g., raw value = 5792 rated current = 500 A Current = 354 A Current (% of rated current) = raw value x 100 / 8192 e.g., raw value = 4096 Current = 50%
14	Load Current I2	Read Only	16-bit, Signed	
15	Load Current I3	Read Only	16-bit, Signed	
16	Frequency	Read Only	16-bit, Signed	Frequency (Hz) = raw value x rated frequency / 8192 e.g., raw value = 8192 rated frequency = 60 Hz Frequency = 60.0Hz
17	Active Event Code	Read Only	16-bit, Signed	See Table 9-2 Event code 0 indicates there are no active events (no warning/fault).

Address	Name	Access	Type	Raw Value & Scaling
18	Auto Increment Register	Read Only	16-bit, Enum	Read = Register automatically increments by 1 every time this is read
26	Product Code	Read Only	16-bit unsigned	7300=AVC
27	SCM Fault Code	Read Only	16-bit unsigned	System configuration manager state (fault code)
28	PQ sag count	Read Only	16-bit unsigned	0%-10%
29	PQ sag count	Read Only	16-bit unsigned	10%-20%
30	PQ sag count	Read Only	16-bit unsigned	20%-30%
31	PQ sag count	Read Only	16-bit unsigned	30%-40%
32	PQ sag count	Read Only	16-bit unsigned	40%-50%
33	PQ sag count	Read Only	16-bit unsigned	50%-60%
34	PQ sag count	Read Only	16-bit unsigned	60%-70%
35	PQ sag count	Read Only	16-bit unsigned	70%-80%
36	PQ sag count	Read Only	16-bit unsigned	80%-90%
37	PQ surge count	Read Only	16-bit unsigned	>110%
38	Output Apparent Power	Read Only	16-bit signed	Per-unit. Base Power = √3 * Rated Voltage (register 4) * Rated Current (register 6)
39	Output Real Power	Read Only	16-bit signed	
100	Time and Date	Read/Write	32-bit unsigned	Unix (Epoch) Time – Number of seconds since 01/01/1970. Note – If write error, enable with menu 731 Date Write Enable
1000	Reset Command	Read/Write	16-bit, Enum	0 = No Action 1 = Reset
1002	Start Command	Read/Write	16-bit, Enum	0 = No Action 1 – Start
1004	Stop Command	Read/Write	16-bit, Enum	0 = No Action 1 = Stop
1006	Output Voltage Setpoint	Read/Write	16-bit, Signed	Voltage (line-to-line RMS volts) = raw value x rated voltage / 8192
1007	Test Register	Read/Write	16-bit, Signed	Dummy read / write register for testing

Address	Name	Access	Type	Raw Value & Scaling
2001-2039	Cached registers 1-39	Read Only	As for registers 1-39	Same as for registers 1-39

Table 10-1: PCS100 AVC-40 Modbus TCP User Parameters

Address	Name	Access	Type	Raw Value & Scaling
2001-2039	Cached registers 1-39 (see section 10.3.2)	Read Only	As for registers 1-39	Same as for registers 1-39

Table 10-2: PCS100 AVC-40 Modbus TCP cached user parameters

10.3.4 Modbus TCP Error Codes

The following error codes may be returned by the Modbus TCP server.

Code	Name	Description
1	Illegal Function	Function code received in the query is not supported by this Modbus TCP server or the query is badly formatted.
2	Illegal Data Address	The data address received in the query is not a valid address in the Modbus TCP server. Specifically, the combination of address and number of registers is not valid. – Register not known by the PCS100 AVC-40 – Register is not in Modbus TCP configuration table – Not all registers of a single parameter accessed – Register / length mismatch
3	Illegal Data Value	The value received in the query is not an allowable value for this register or the implied length is invalid. – Value out of range for parameter – Number of registers requested exceeds max.
4	Slave Device Failure	An unrecoverable error occurred while server attempted to perform requested action. – Read/Write access violation – GDM hardware issues – Insufficient access privileges
6	Slave Device Busy	The Modbus TCP server is unable to process this command at present. Retry this command again later. – GDM VCAN server busy or unavailable

10.4 Email Connectivity

PCS100 AVC-40 is configurable for sending e-mail notifications in case of power quality event or systems internal event as faults and warnings.
Automatic sending of the service logs via e-mail to ABB Service can also be enabled.

Figure 10-10 highlights the Email Menu Page which shows the parameters that the operator needs to set up as described in Sections 10.4.1 – 10.4.4

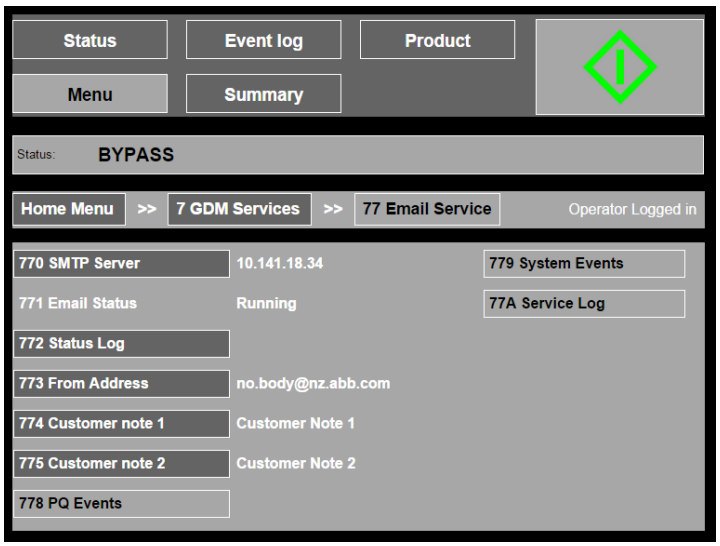


Figure 10-10: Email Menu Page

10.4.1 Setting up Email Server

The Email Notification Service (ENS) requires an SMTP server to send its emails out that is accessible on the local network and does not support authentication. The GDM needs to be configured for the local network – refer to Sections 10.2.1 - 10.2.2 for configuration instructions.

A minimum of operator access is required to configure the ENS via the GDM Menu.

The email server should be set up as described below:

- From the GDM menu select “7 GDM Services” and then select “77 Email Service”.
- Select “770 SMTP Server” and enter the IP address of the SMTP server.
- Select “773 From Address” and enter an address that the email server will accept.
- Enter the Customer notes as required using menu “774 and 775 Customer note 1 and 2”. Here the customer is free to enter additional information.

Note: The Email server is not contacted until an email is sent either by an event trigger or the force email function.

10.4.2 Setting up Power Quality Notifications

The menu item “778 PQ Events” under the Email service menu is used to configure and test the PQ event email notifications.

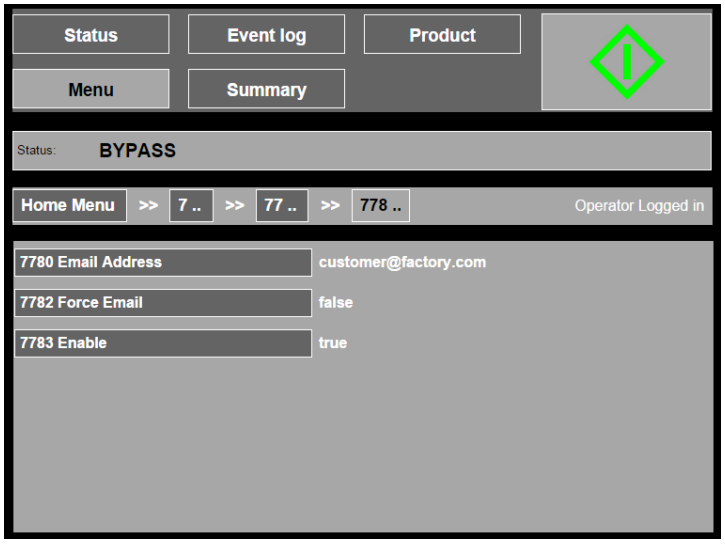


Figure 10-11: Setup page for PQ event email notifications.

10.4.2.1 Set up Instructions

Select the menu “7780 Email address” and enter the destination email address for the notification to be sent to.
Select the menu “7783 Enable” and set it to true.

10.4.2.2 Testing Set Up

To test the notification service, select the menu “7782 Force Email” the set it to true. This will attempt to send out an email using the email server settings and the email address entered in “7780 Email address”. It is necessary to allow up to two minutes for the email to be sent.

10.4.2.3 Description of Power Quality Event Notification

Below is an example of a typical email sent to notify the customer of a power quality event.

From: AVC-40@nz.abb.com
Sent: Tuesday, 22 September 2015 10:52 a.m.
To: Customer <customer@factory.com>
Subject: Power Quality Event 12345678

Customer:	ABB NZ	
Site Name:	Napier	
Plant Name:	Site 1	← Site Information
Note:	AVC connected to Production Line 75	
Note:	Feeder 12 O/G	

Product type:	PCS100 AVC-40	
Model:		
Product Rated voltage:	480.00 V	← Product Information
Product Rated Power:	450 kVA	

Date	2015-09-21	← Date and time
Time	10:49:38.27	

Input voltage V1	80%	
Input voltage V2	82%	← Utility sag at input to PCS100 AVC-40
Input voltage V3	87%	
Output voltage V1	100%	
Output voltage V2	100%	← PCS100 AVC-40 sag correction
Output voltage V3	99%	
Duration	200 ms	← Sag duration

Event type	sag	← Type of PQ event
System Status	running	← Status of PCS100 AVC-40

10.4.3 Setting Up System Event Notifications

The menu item “779 System Events” under the Email service menu is used to configure and test the System Event email notifications.

Figure 10-12: Setup Page for System Event email notifications

10.4.3.1 Set Up Instructions

Select the menu “7790 Email Address” and enter the destination email address for the notifications to be sent to.
Select the menu “7791 Trigger Type” and select desired event type to trigger the email. The three event types are:

- Trigger notification on Fault
- Trigger notification on Warning
- Trigger notification on Power Quality

Note: It is possible to select any or all of the event type options.

Select the menu “7793 Enable” and set it to true.

10.4.3.2 Testing

To test the System event email service, select the menu “7792 Force Email” and set it to true. This will attempt to send out an email using the email server settings and the email address supplied in “7790 Email address”.

10.4.3.3 Description of System Event Notification

Below is an example of a typical email sent to notify the customer of a system event.

From: AVC-40@nz.abb.com
Sent: Saturday, 19 September 2015 4:31 p.m.
To: Customer <customer@factory.com>
Subject: System Event 60001234 fault

Customer:	ABB NZ
Site Name:	Napier
Plant Name:	Site 1
Note:	AVC connected to Production Line 75
Note:	Feeder 12 O/G

Site Information

Product type:	PCS100 AVC-40
Model:	
Product Rated voltage:	480.00 V
Product Rated Power:	450 kVA

Product Information

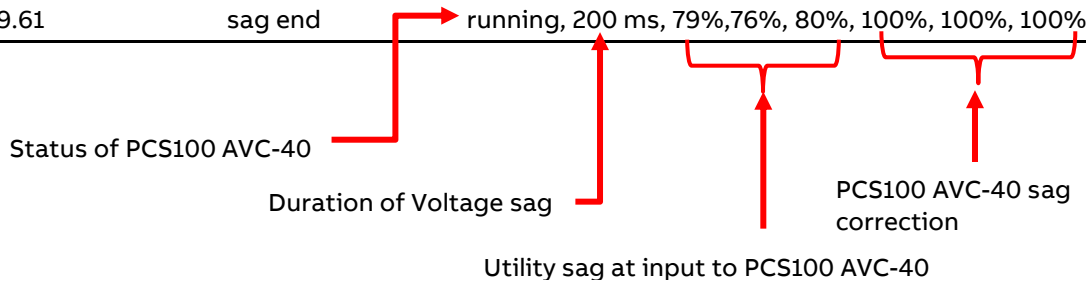
Date	2015-09-18
Time	16:30:13.34

Date and time

Event Code:	2
Event Description:	desat

Highlights

Date	Time	Origin	Event	Code	Description
2015-09-18	16:30:22.00	Scm	scm info	1002	scm power up
2015-09-18	16:30:19.00	Scm	scm info	1001	scm power supply fail
2015-09-18	16:30:19.00	inverter 1	scm info	1008	presence message seen
2015-09-18	16:30:13.91	System	fault	70	inverter lost
2015-09-18	**16:30:13.34**	**inverter 1**	**fault**	**2**	**desat**
2015-09-18	16:30:13.25	inverter 1	warning	4	lvdc psu voltage low
2015-09-18	16:24:39.61		sag end		running, 200 ms, 80%, 75%, 80%, 100%, 100%, 100%
2015-09-18	16:24:39.61		sag end		running, 200 ms, 79%,76%, 80%, 100%, 100%, 100%



Note: The table lists the System and PQ events. The event that triggers the email is highlighted in bold text.

10.4.4 Service Log Email Notification

The purpose of the service log email notification is to email service logs to the factory on the 1st day of every month. The email address “77A0 Email Address” is set up in the factory. The operator must decide if this functionality should be enabled. To enable the service the menu “77A2 Enable” must be set to true.

10.4.4.1 Testing

Once the Service Log Email Notification has been enabled, it can be tested by selecting the menu “77A1 Force Email” and setting it to true. This will attempt to send out an email using the email server settings and the email address entered in “77A0 Email Address”.

Note: The service log can take up to an hour to generate.

10.4.5 Email Service Status Log

The “722 Status Log” screen can be viewed to see the status messages and error messages when the Email service is used.
For example, if message sending works successfully, the “772 Status Log” will show “Server Connection Successful” followed by “Sending message”.

11 WIRING

The PCS100 AVC-40 utility supply (input) and load (output) connections are connected directly to the Injection Transformer terminals in the Transformer Enclosure(s).
The following table defines connection sides.

Transformer terminals	Connection
Top terminals	Utility Supply (Input)
Bottom Terminals	Load (Output)

Table 11-1: PCS100 AVC-40 power terminals.

Figure 11-1 below shows power connection location on frame size 4B system (example of system with separate Transformer Enclosure).
Refer to section 17.6 for termination details in different frame sizes.

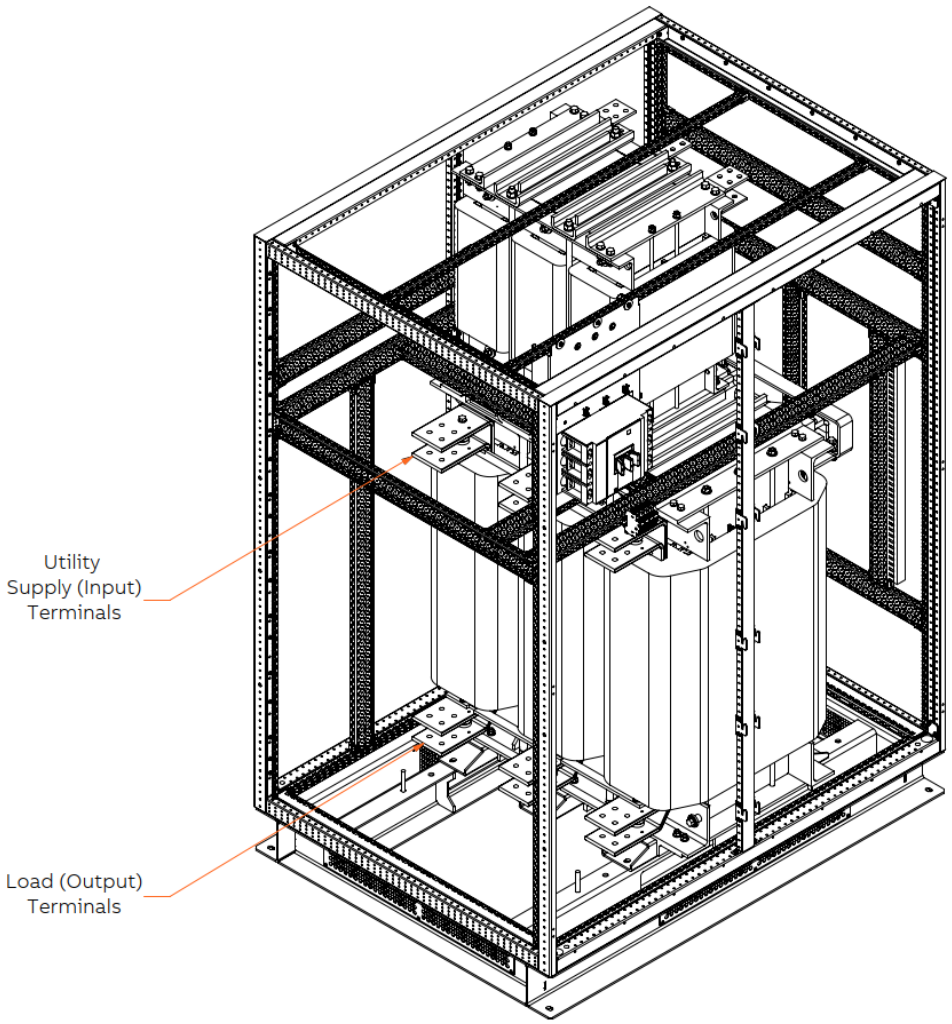


Figure 11-1: PCS100 AVC-40 frame size 4B transformer enclosure

Systems with frame sizes 8B and above have two Transformer Enclosures where each enclosure houses an Injection Transformer connected in series. One Transformer Enclosure contains input terminals for the utility supply while the other contains output terminals for the load as shown in Figure 11-2

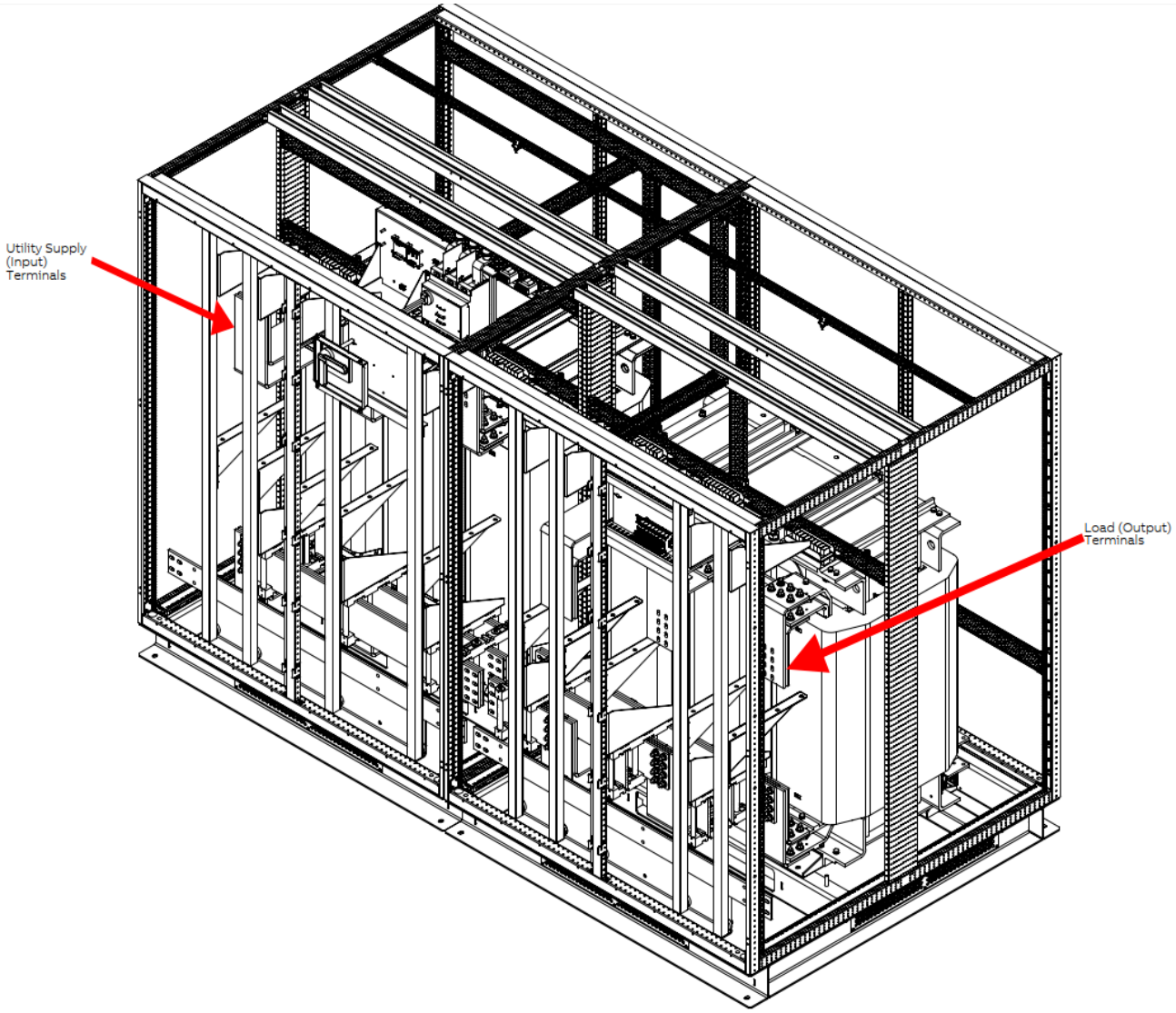


Figure 11-2: PCS100 AVC-40 transformer enclosure (frame size 10B)

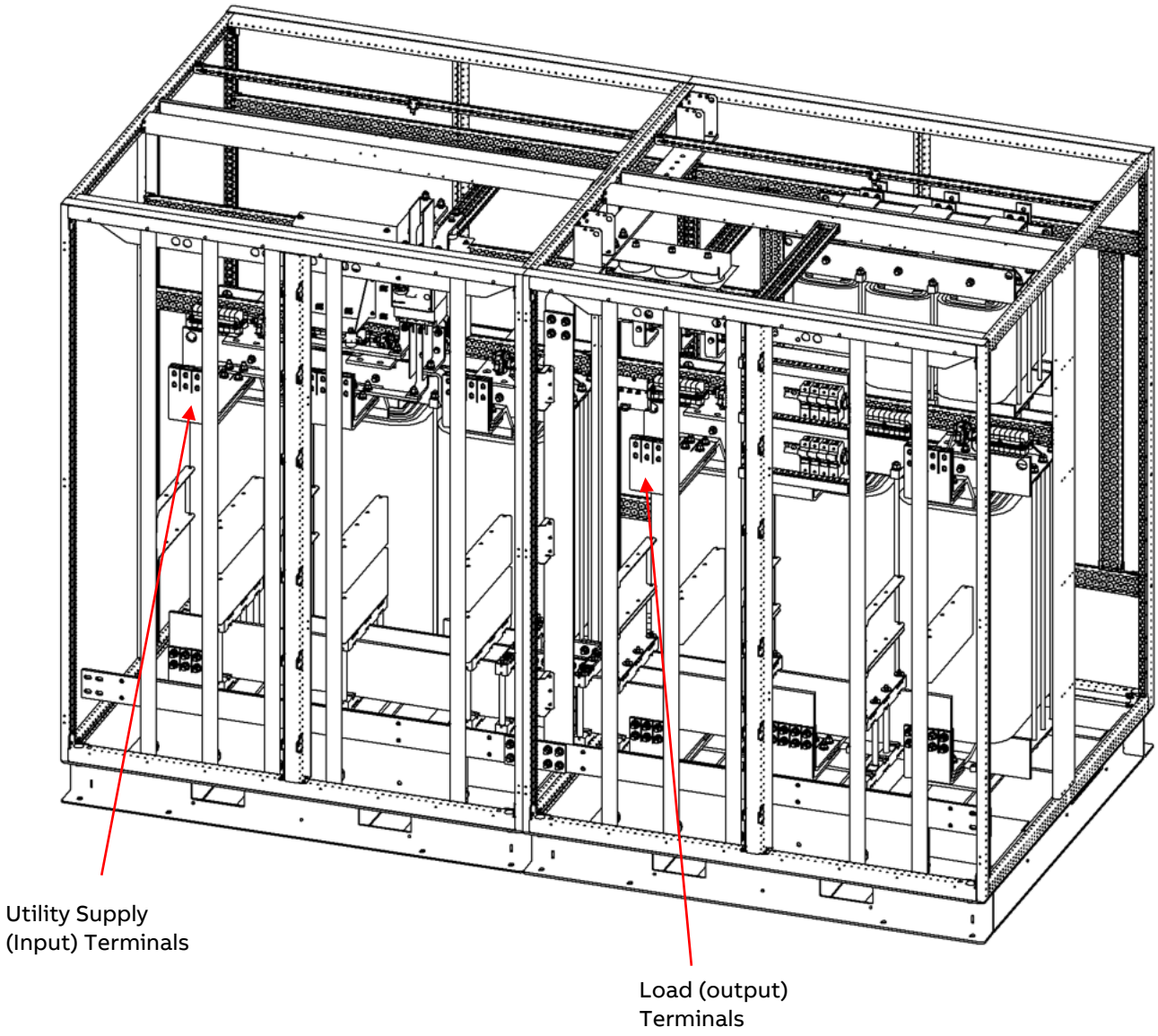


Figure 11-3: PCS100 AVC-40 600/690 V transformer enclosure (frame size 12B)

11.1 Control Connection

PCS100 AVC-40 includes control connections for the need of local control or monitoring of the system.
Control connection terminals are located on Auxiliary Master Module at the bottom of the Master Controller Enclosure.

11.1.1 Digital Inputs and Outputs

Digital input and output terminals are located on Auxiliary Master Module at the bottom of the Master Controller Enclosure and numbered as shown in Figure 11-5 and explained in Table 11-2.

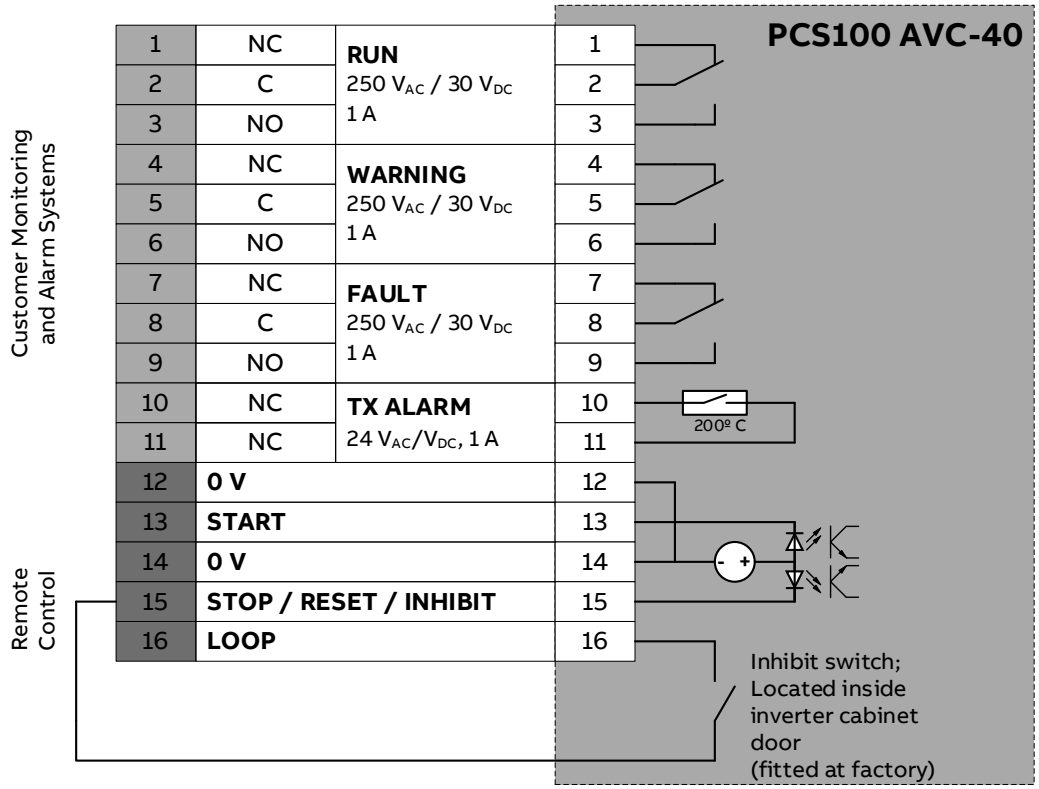


Figure 11-4: Customer Terminals for Remote Control and Monitoring of PCS100 AVC-40

Terminal Number	Description	Name
1	Relay output/250 V_{AC}/30 V_{DC}, 1 A/NC	RUN
2	Relay output/250 V_{AC}/30 V_{DC}, 1 A/C	RUN
3	Relay output/250 V_{AC}/30 V_{DC}, 1 A/NO	RUN
4	Relay output/250 V_{AC}/30 V_{DC}, 1 A/NC	WARNING
5	Relay output/250 V_{AC}/30 V_{DC}, 1 A/C	WARNING
6	Relay output/250 V_{AC}/30 V_{DC}, 1 A/NO	WARNING
7	Relay output/250 V_{AC}/30 V_{DC}, 1 A/NC	FAULT
8	Relay output/250 V_{AC}/30 V_{DC}, 1 A/C	FAULT
9	Relay output/250 V_{AC}/30 V_{DC}, 1 A/NO	FAULT
10	Isolated thermal switch/24 V_{AC}/24 V_{DC}, 1 A/NC	Transformer overtemperature information. The transformer is overheating if this circuit opens. This circuit must be monitored, and action taken to reduce the temperature of the transformer if it is overheated. Overheating may occur due to cooling fan failure, cooling path blockage or current overload.

Terminal Number	Description	Name
11	Isolated thermal switch/24 V_{AC}/24 V_{DC}, 1 A/NC	Transformer alarm – return
12	Dry contact only: Return Wire	Start Input – return
13	Dry contact only: Start on closing edge	Start Input – only used if remote Start is required
14	Dry contact only: Return Wire	Stop/Reset – return
15	Dry contact only: Stop on open edge: Inhibit while open; Reset on open edge	Stop/Reset – input – link according to required function
16	Terminal	Stop/Reset loop

Table 11-2: Remote Control and Monitoring via Customer Terminals

The following control connections are available for wired remote control or monitoring of PCS100 AVC-40.

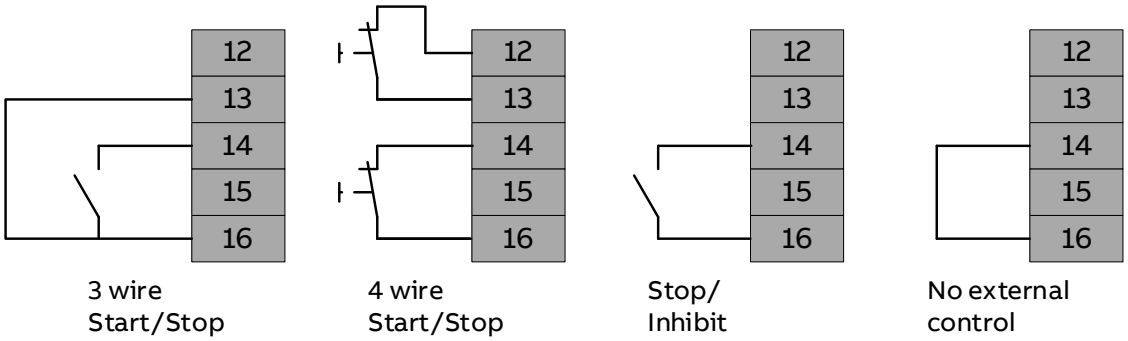


Figure 11-5: Control wiring options.

Note: “No external control” link is fitted in factory by standard.

11.1.2 Relay Outputs

The product status is indicated by the relay outputs mounted on the front of the Auxiliary Master Module and may be used for external customer monitoring.

Relay	Product status or description
RUN	Active in RUN, AUTO BYPASS, STARTING, STOPPING. Not active in BYPASS, FAULT
WARNING	Active if user WARNING condition present (temperature or overload warnings) and during power up.
FAULT	Not active if FAULT or PCS100 AVC-40 is powered down.

Table 11-3: PCS100 AVC-40 relay outputs.

11.2 Stop – Enable Switch

A Stop-Enable switch is mounted inside of the Master Controller Enclosure as a failsafe device.
In case of any user interface display or remote-control failure this switch can be used to stop the PCS100 AVC-40 operating and put it into BYPASS mode by setting to STOP. This will inhibit PCS100 AVC-40 from starting.

This switch is wired in series with the remote inhibit input above.

Returning this switch to Enable will enable the controller but not start it. A local or remote start is needed to bring the system out of BYPASS.

12 MAINTENANCE

The PCS100 AVC-40 has been designed for ease of maintenance.

DANGER
This manual does not provide sufficient information for safe service of the PCS100 AVC-40. For such service information refer to appropriate manual.

Refer to document 2UCD074000E410 PCS100 AVC-40 Maintenance Schedule for details of recommended maintenance.
Maintenance must be carried out by suitably trained staff. The equipment must be de-energized and allowed to discharge before beginning inspections.

12.1 Maintenance Schedule

Recommended maintenance intervals and component replacements are based on specified operational and environmental conditions. ABB recommends product inspections according to list below to ensure the highest reliability and optimum performance. More detailed maintenance information can be found in the product manuals and detailed maintenance instructions.
For more information consult ABB Service: **NZ-powerconditioningservice@abb.com**

	Legend
R	**R**eplacement of component
I	**I**nspection (visual inspection, correction and replacement if needed)
S	On-**S**ite work (tests, measurements, etc.)

Recommended maintenance actions	**Activity**	**Period**
Cooling		
Air ducts	I	1 year
All fans	I	1 year
Connections and surroundings		
Thermal scan	I	1 year
Tightness of terminals	I	5 years
Dust, corrosion and temperature	I	1 year
Communications cables and connections	I	1 year
Aging		
AC filter capacitors	S	1 year
Spare Parts		
Spare parts	I	1 year
PCS100 power module DC bus capacitor reforming	I	3 years
Improvements		
Software upgrades	I	1 year

Note: For critical applications and applications where there is the possibility of poor environmental conditions it is recommended to shorten the above recommended periods.

Schedule of component replacement for product operation in environmental conditions up to 40° C			
		Years from start-up	
Component	**Note**	**5**	**10**
Cooling			
PCS100 power module fan		R	R
Aging			
CANbus cable replacement[1]			R
AC filter capacitors[2]			R
Auxiliary module power supply		R	R
Surge Protection Devices (SPDs)		R	R
SCM board	SCM rev F and earlier, systems built before 18/6/2015		R
SCM board battery	SCM rev G and later, systems built after 18/6/2015		R

Schedule of component replacement for product operation in environmental conditions up to 30° C			
		Years from start-up	
Component	**Note**	**5**	**10**
Cooling			
PCS100 power module fan		R	R
Aging			
CANbus cables replacement[1]			R
AC filter capacitors[2]			R
Auxiliary module power supply	systems built before 31/7/2017	R	R
Auxiliary module power supply	systems built after 31/7/2017		R
Surge Protection Devices (SPDs)		R	R
SCM board	SCM rev F and earlier, systems built before 18/6/2015		R
SCM board battery	SCM rev G and later, systems built after 18/6/2015		R

If for any reason there is the need to replace a module from year 8 onward, we recommend that the opportunity is taken to replace the CAN bus cables at this time.

Consult ABB Service for maintenance recommendations at: **NZ-powerconditioningservice@abb.com**

12.2 Repairs

All repairs must be performed by ABB Service or an authorized service agent. When contacting ABB Service please provide the serial number of the PCS100 AVC-40 and a copy of the Service Log which can be downloaded via the Web pages as described in section 10.2.6.

[1] If for any reason there is the need to replace a module from year 8 onward, we recommend that the opportunity is taken to replace the CANbus cables at this time.

[2] Valid for THD_V <8%. For THD_V >8% components' lifetime is likely to be reduced.

13 DIMENSIONS AND LAYOUTS

13.1 Dimensions and Weights

The following tables show the dimensions and weights of Controller Enclosure and Injection Transformer Enclosure in different frame sizes.

13.1.1 PCS100 AVC-40 Models

Frame Sizes	Controller Enclosure Dimensions (H×W×D)	Transformer Enclosure Dimensions (H×W×D)	Controller enclosure Weight 220 V models	Transformer Enclosure Weight 220 V models	Controller Enclosure Weight 400 and 480 V models	Transformer Enclosure Weight 400 and 480 V models
2B	(2168x830x844) mm	(2168x830x844) mm	(607+±10%) kg	(1638±10%) kg	(607±10%) kg	(1317±10%) kg
3B	(2168x830x844) mm	(2168x830x1244) mm	(763±10%) kg	(2348±10%) kg	(763±10%) kg	(1978±10%) kg
4B	(2168x1630x844) mm	(2168x1630x1244) mm	(1214±10%) kg	(3920±10%) kg	(1214±10%) kg	(3124±10%) kg
5B	(2168x1630x844) mm	(2168x1630x1244) mm	(1371±10%) kg	(3920±10%) kg	(1371±10%) kg	(3124±10%)kg
6B	(2168x1630x844) mm	(2168x1630x1244) mm	(1528±10%) kg	(3920±10%) kg	(1528±10%) kg	(3124±10%)kg
8B	(2168x3230x844) mm	(2168x3230x1690) mm	N/A	N/A	(2582±10%) kg	(7748±10%)kg
10B	(2168x3230x844) mm	(2168x3230x1690) mm	N/A	N/A	(2738±10%) kg	(7748±10%)kg
12B	(2168x3230x844) mm	(2168x3230x1690) mm	N/A	N/A	(3044±10%) kg	(7748±10%)kg

Side-By-Side 8-12B Weights

Frame Sizes	Controller Enclosure Dimensions (H×W×D)	Transformer Enclosure Dimensions (H×W×D)	Cable Run cabinets weight 400V/480V models	Controller Enclosure Weight 400 and 480 V models	Transformer Enclosure Weight 400 and 480 V models
8B	(2168x3230x844) mm	(2168x3260x1690) mm	(418±10%) kg	(2582±10%) kg	(7748±10%) kg
10B	(2168x3230x844) mm	(2168x3260x1690) mm	(418±10%) kg	(2738±10%) kg	(7748±10%) kg
12B	(2168x3230x844) mm	(2168x3260x1690) mm	(418±10%) kg	(3044±10%) kg	(7748±10%) kg

Back-to-Back 600/690 V 12B Weights

Frame Sizes	Controller Enclosure Dimensions (H×W×D)	Transformer Enclosure Dimensions (H×W×D)	Controller Enclosure Weight 600 and 690 V models	Transformer Enclosure Weight 600 and 690 V models
12B	(2168x3230x844) mm	(2168x3260x1690) mm	(3044±10+10%) kg	(7300±10%) kg

Table 13-1: PCS100 AVC-40 dimensions and weights

Note: Allow ±10% tolerance for all weights shown in tables above.

13.2 Individual Enclosures – Plan View

The following plan views show the dimensions and require clearances of the enclosures.

13.2.1 Controller Enclosures

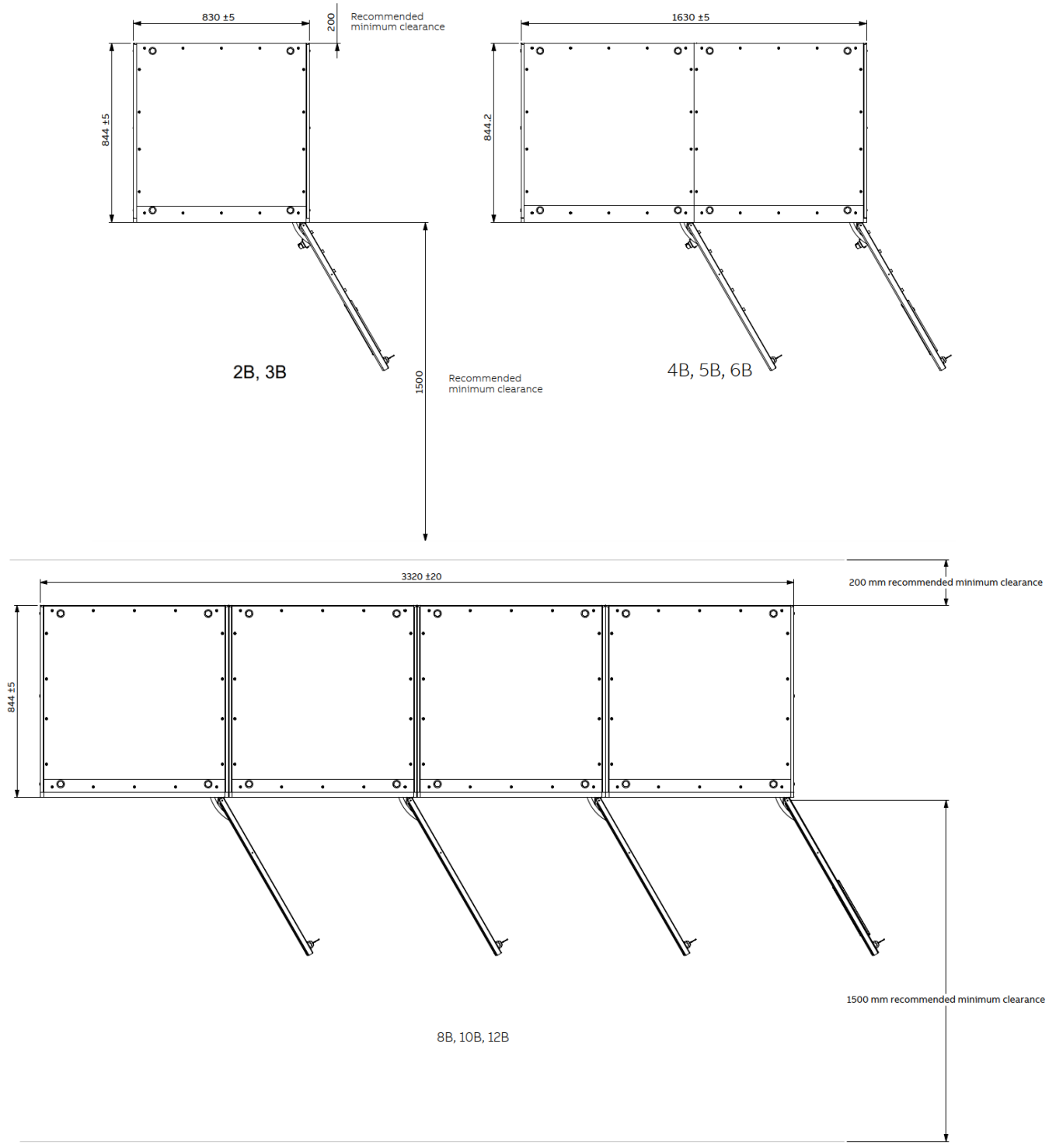


Figure 13-1: PCS100 AVC-40 controller enclosure plan view

13.2.2 Transformer Enclosures

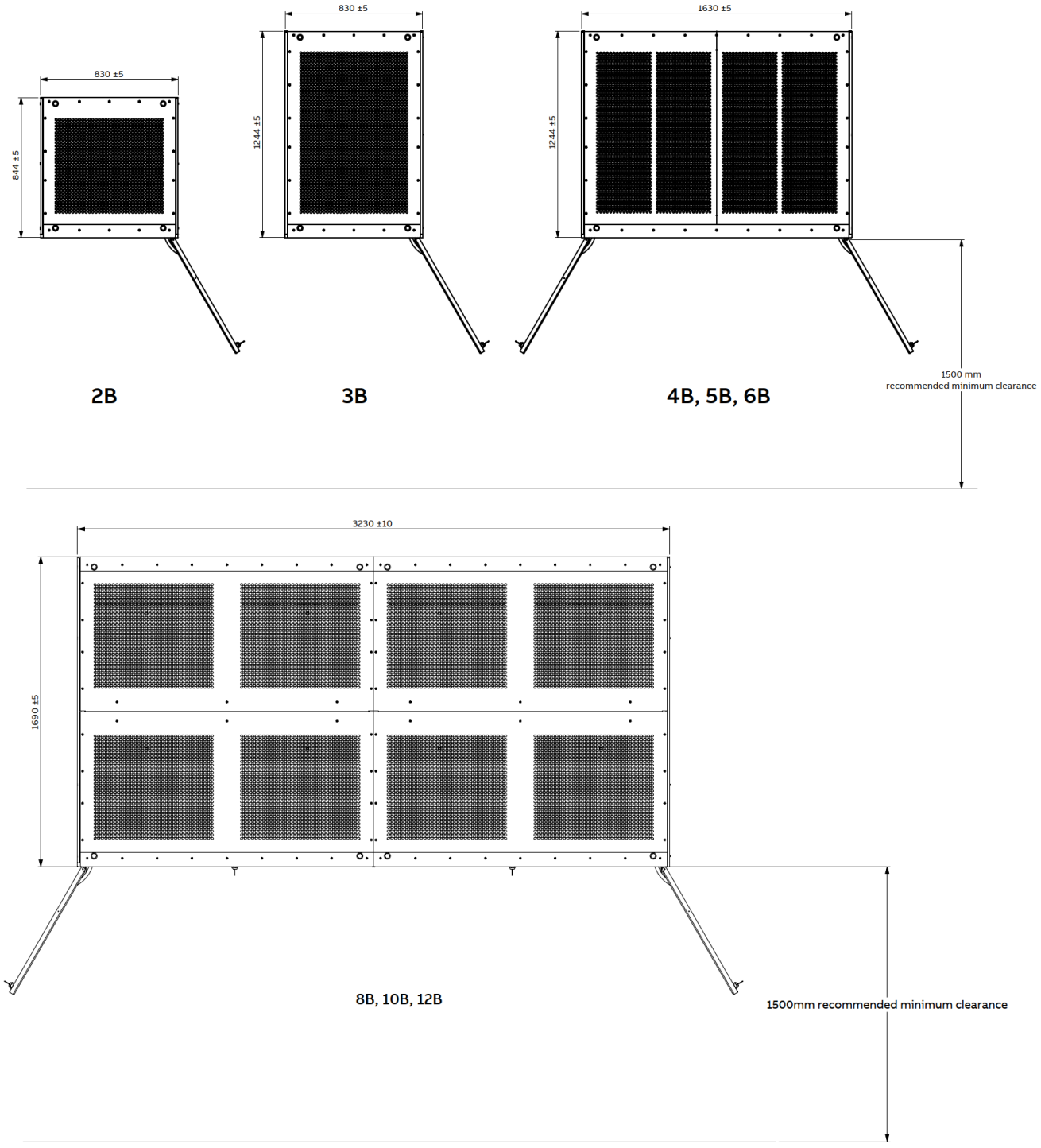
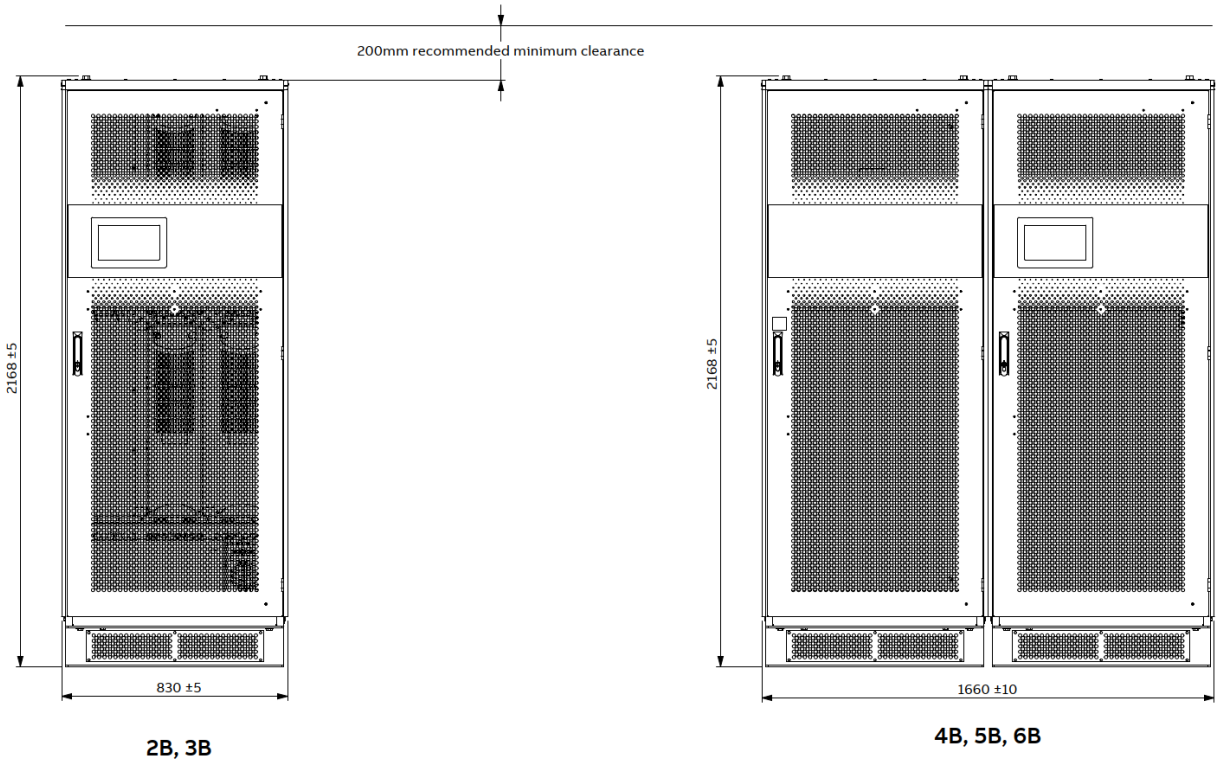


Figure 13-2: PCS100 AVC-40 transformer enclosure plan view.

13.3 Individual Enclosures – Elevations

The following front elevations show the height of the enclosures and clearance required above each enclosure.

13.3.1 Controller Enclosures



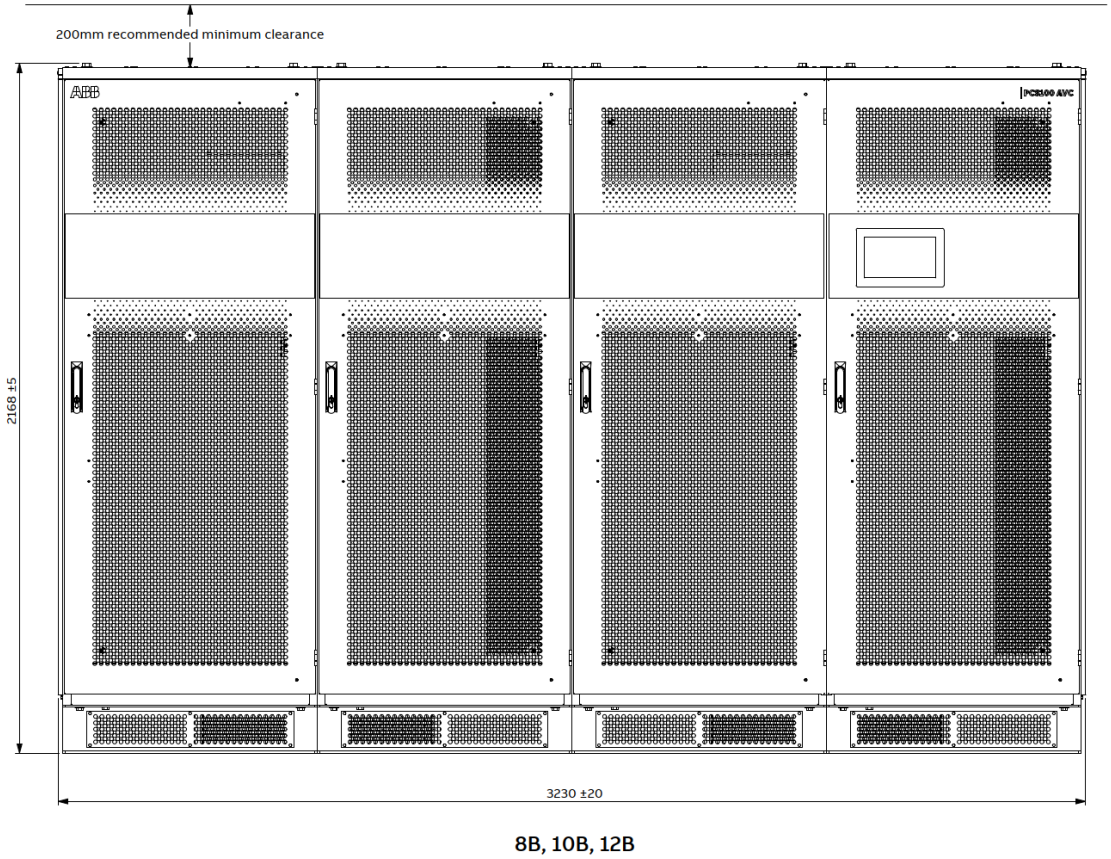
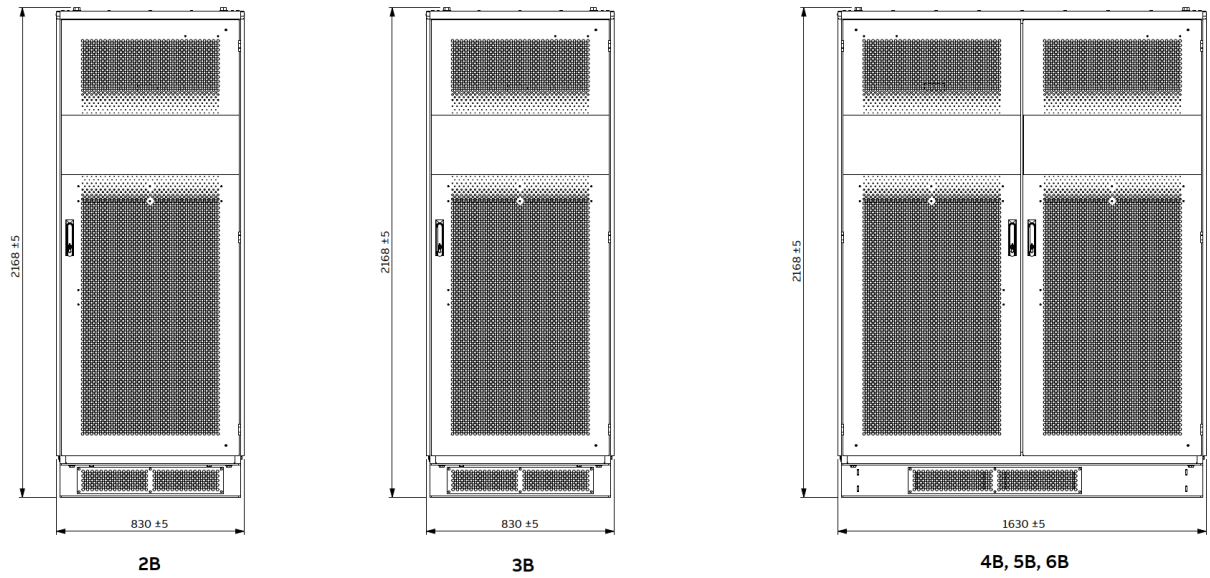


Figure 13-3: PCS100 AVC-40 controller enclosure elevation.

13.3.2 Transformer Enclosures

Note that the depth of the 2B and 3B Transformer Enclosures are different.



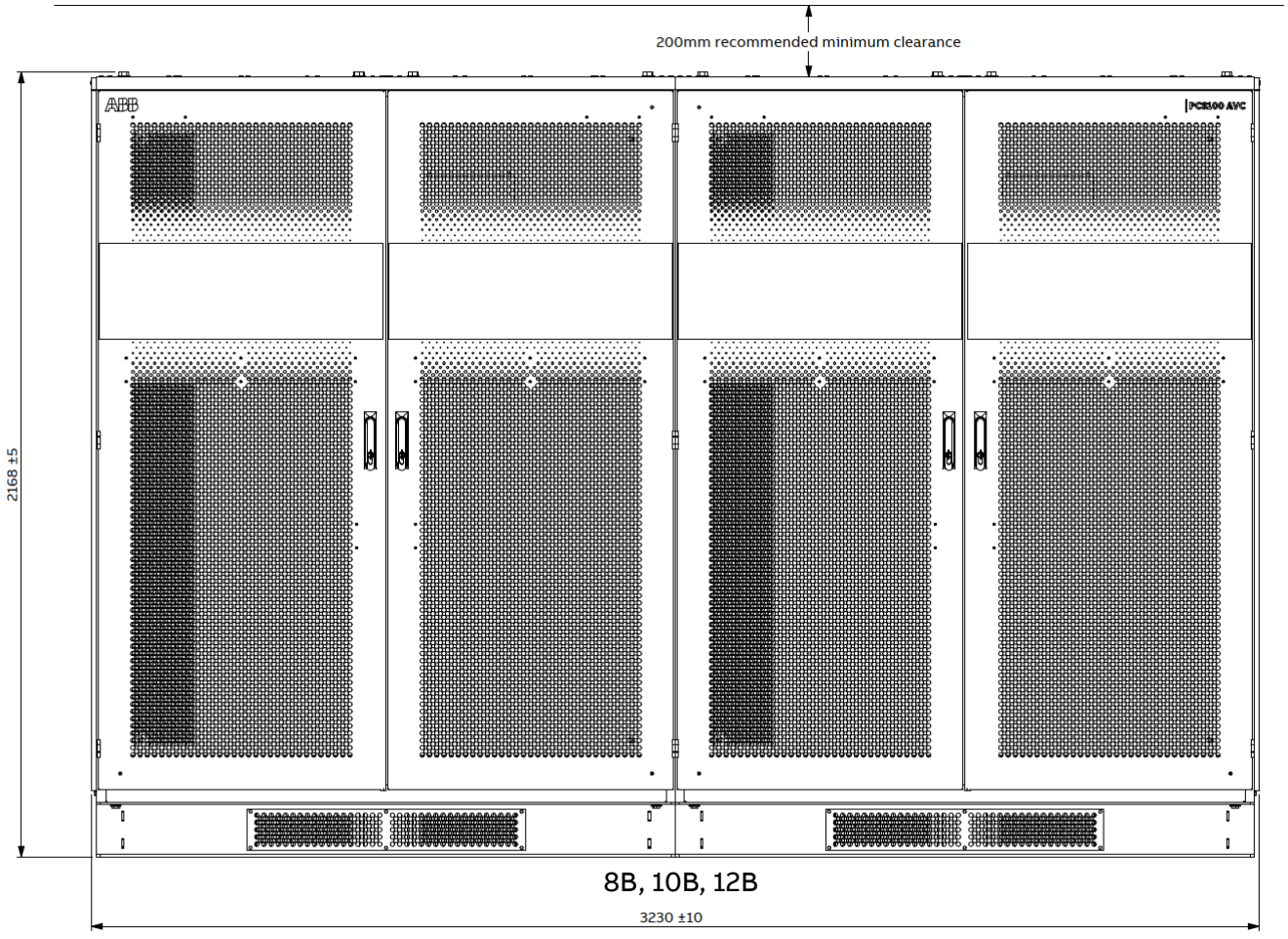


Figure 13-4: PCS100 AVC-40 transformer enclosure elevation.

13.4 Layouts

13.4.1 Frame Size 2B

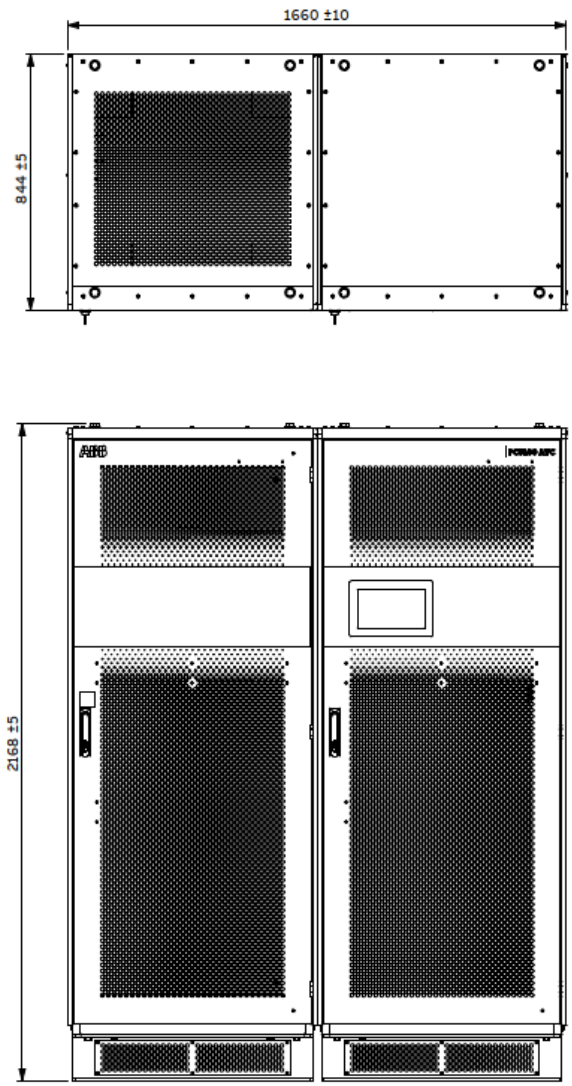


Figure 13-5: PCS100 AVC-40 2B frame size with right (R) connection side Side-by-Side layout

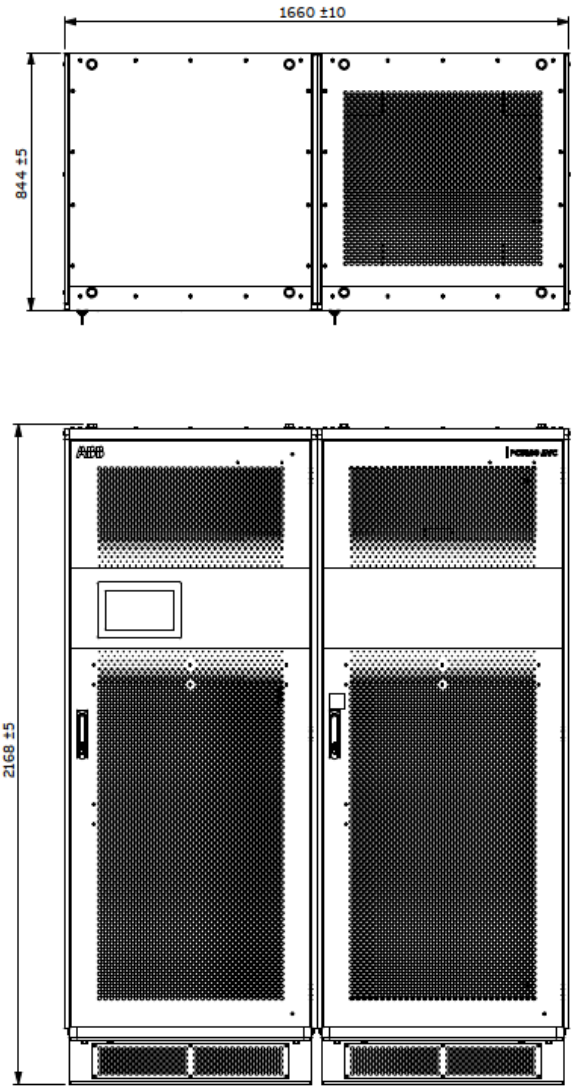


Figure 13-6: PCS100 AVC-40 2B frame size with left (L) connection side Side-by-Side layout

13.4.2 Frame Size 3B

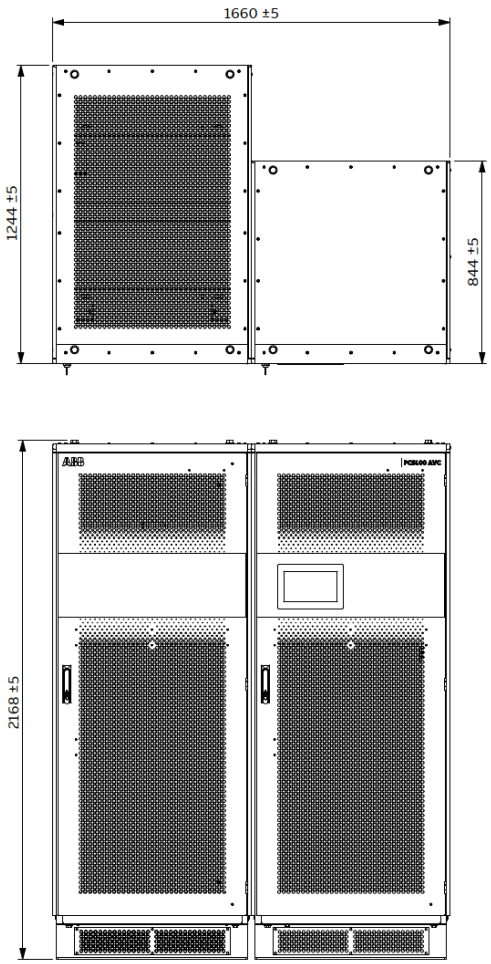


Figure 13-7: PCS100 AVC-40 3B frame size with right (R) connection side Side-by-Side layout

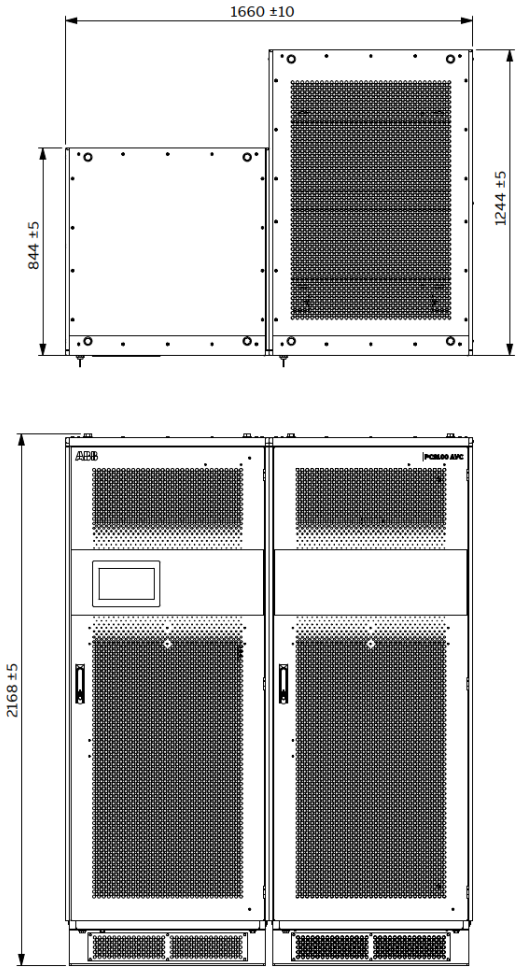
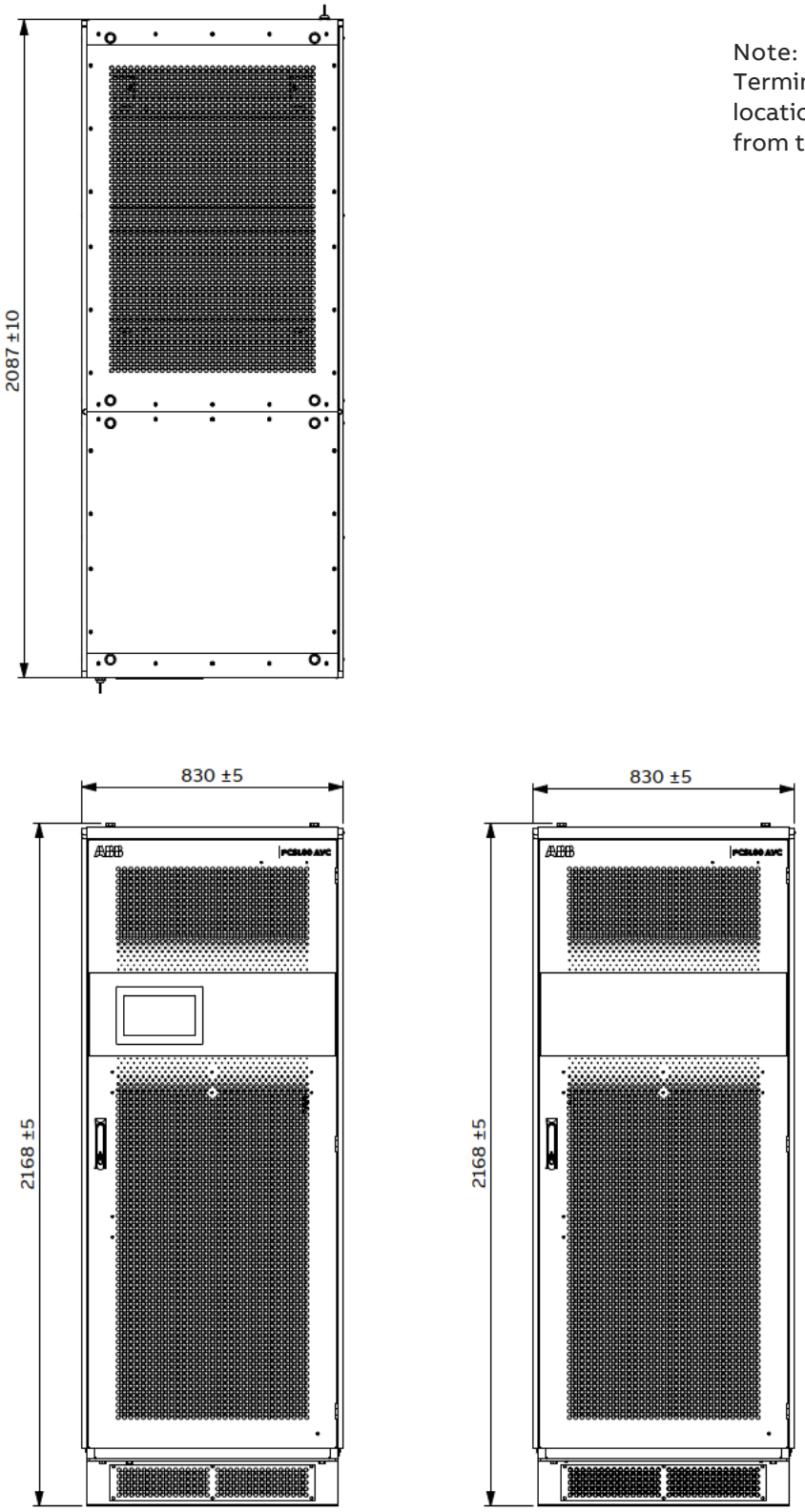


Figure 13-8: PCS100 AVC-40 3B frame size with left (L) connection side Side-by-Side layout



Note:
Termination side is determined by the location of power terminals when viewed from the front of Transformer Enclosure.

Figure 13-9: PCS100 AVC-40 3B frame size Back-to-Back layout

13.4.3 Frame Sizes 4B, 5B and 6B

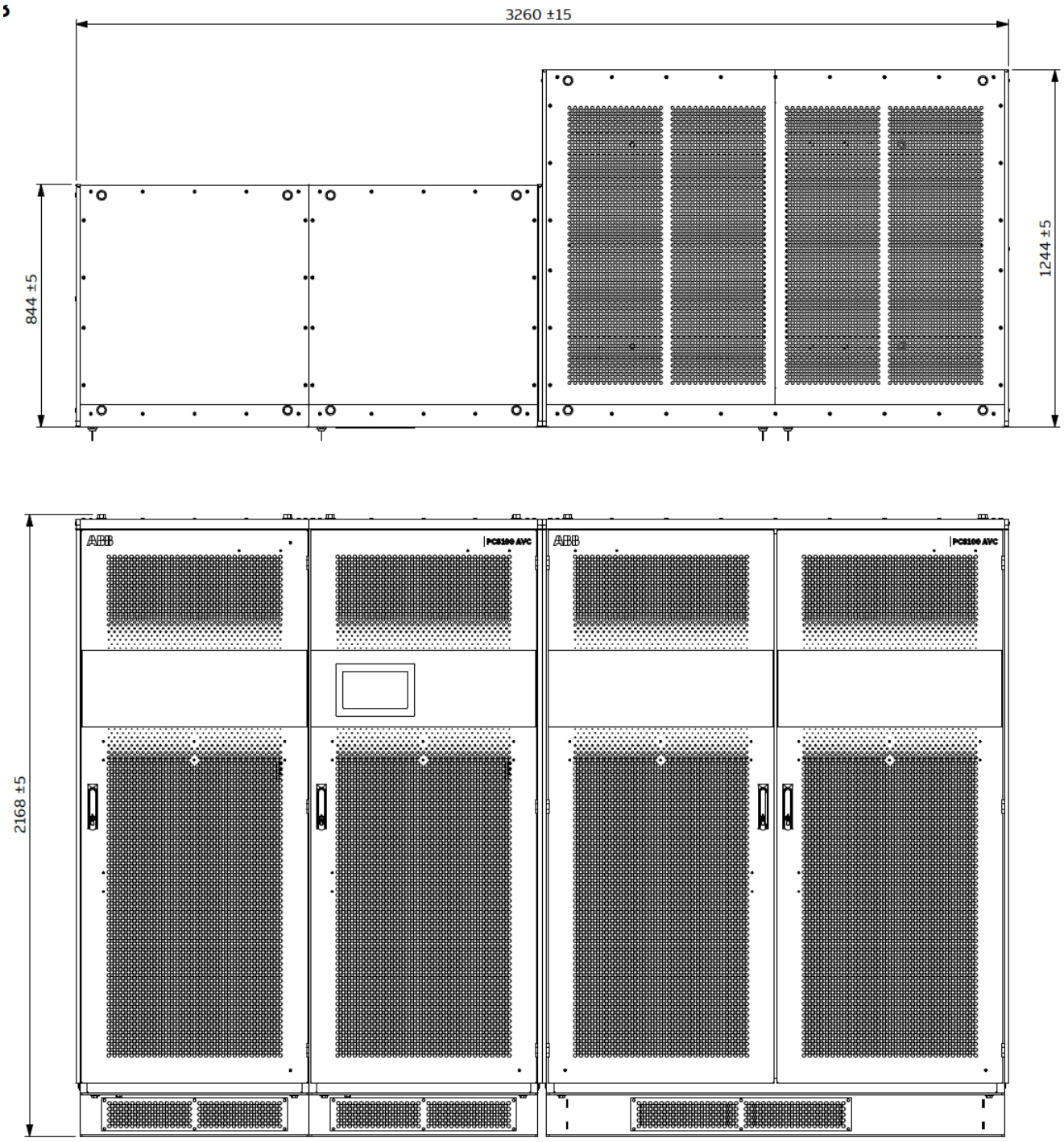


Figure 13-10: PCS100 AVC-40 4B, 5B and 6B frame size with Right (R) connection side Side-by-Side layout

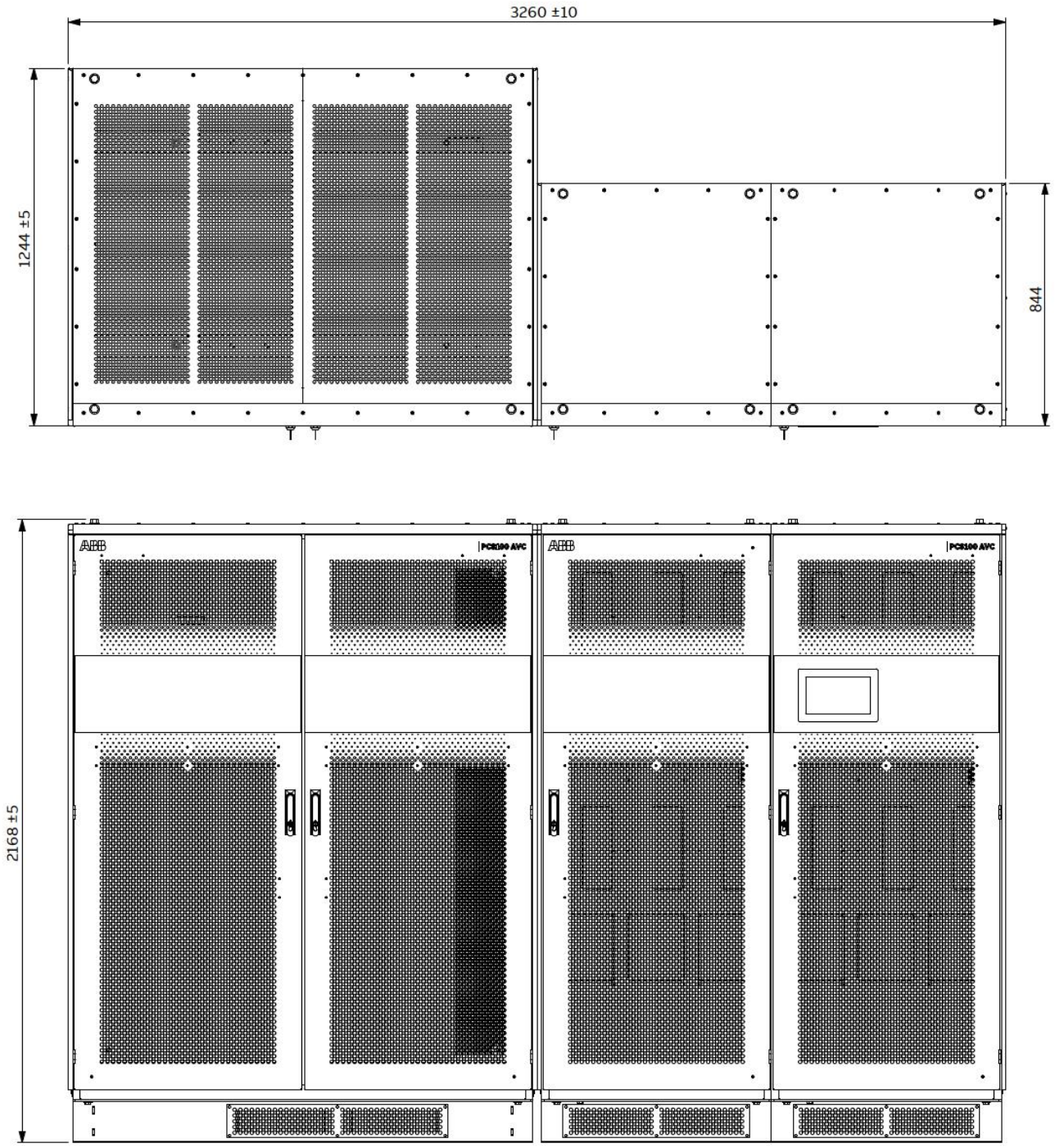
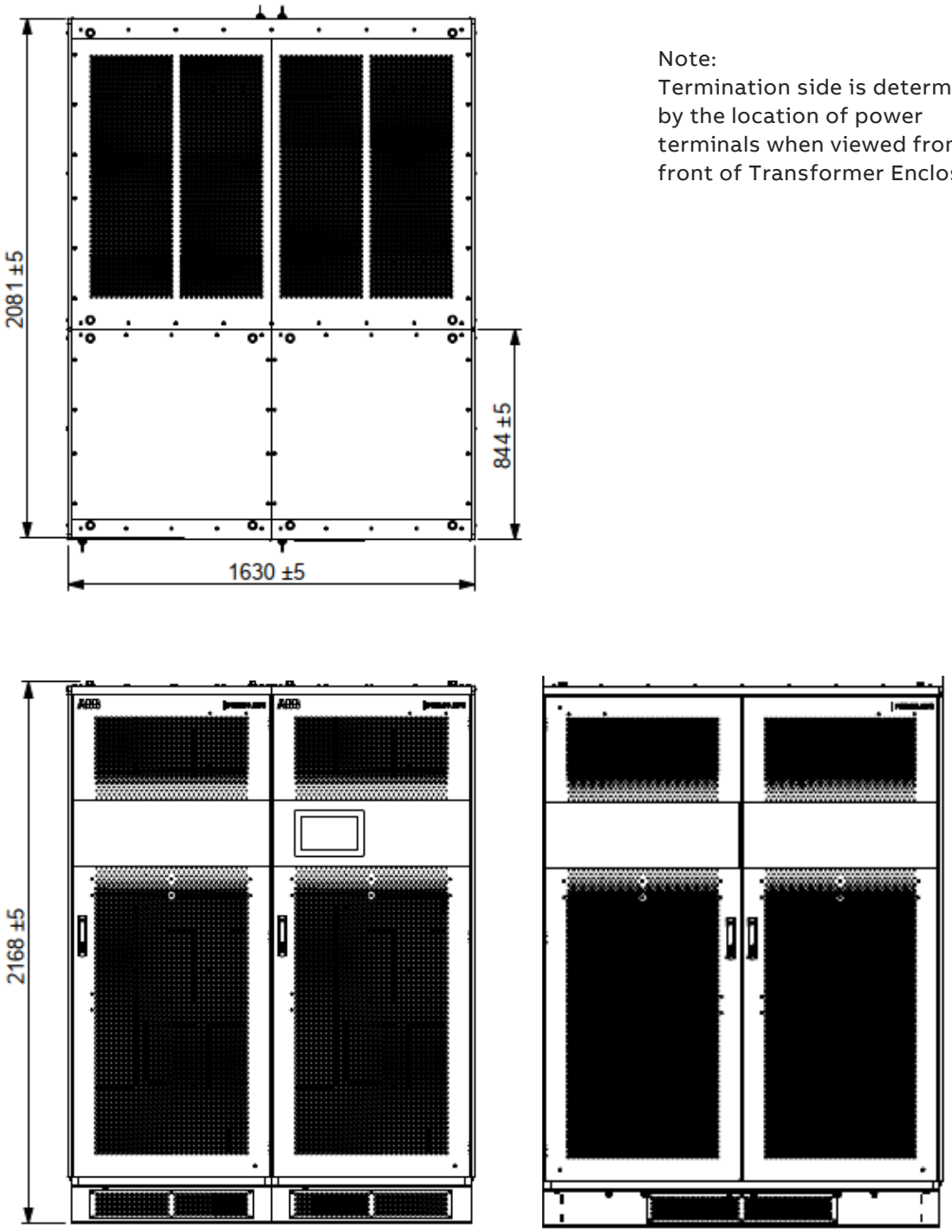


Figure 13-11: PCS100 AVC-40 4B, 5B and 6B frame size with left (L) connection side Side-by-Side layout



Note:
Termination side is determined by the location of power terminals when viewed from the front of Transformer Enclosure.

Figure 13-12: PCS100 AVC-40 4B, 5B and 6B frame size Back-to-Back layout

13.4.4 Frame Sizes 8B, 10B and 12B

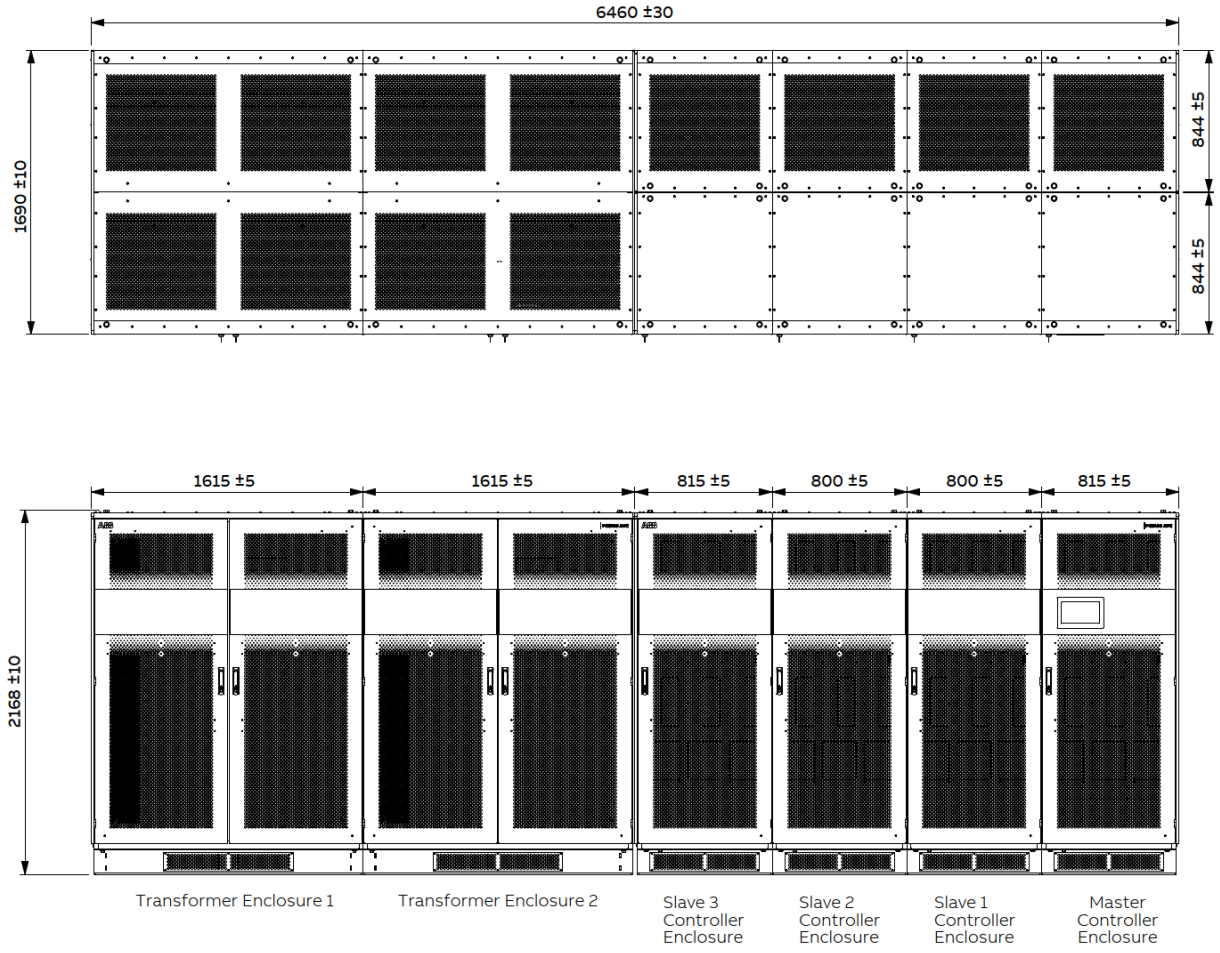


Figure 13-13: PCS100 AVC-40 8B, 10B and 12B frame size with Right (R) connection side Side-by-Side layout

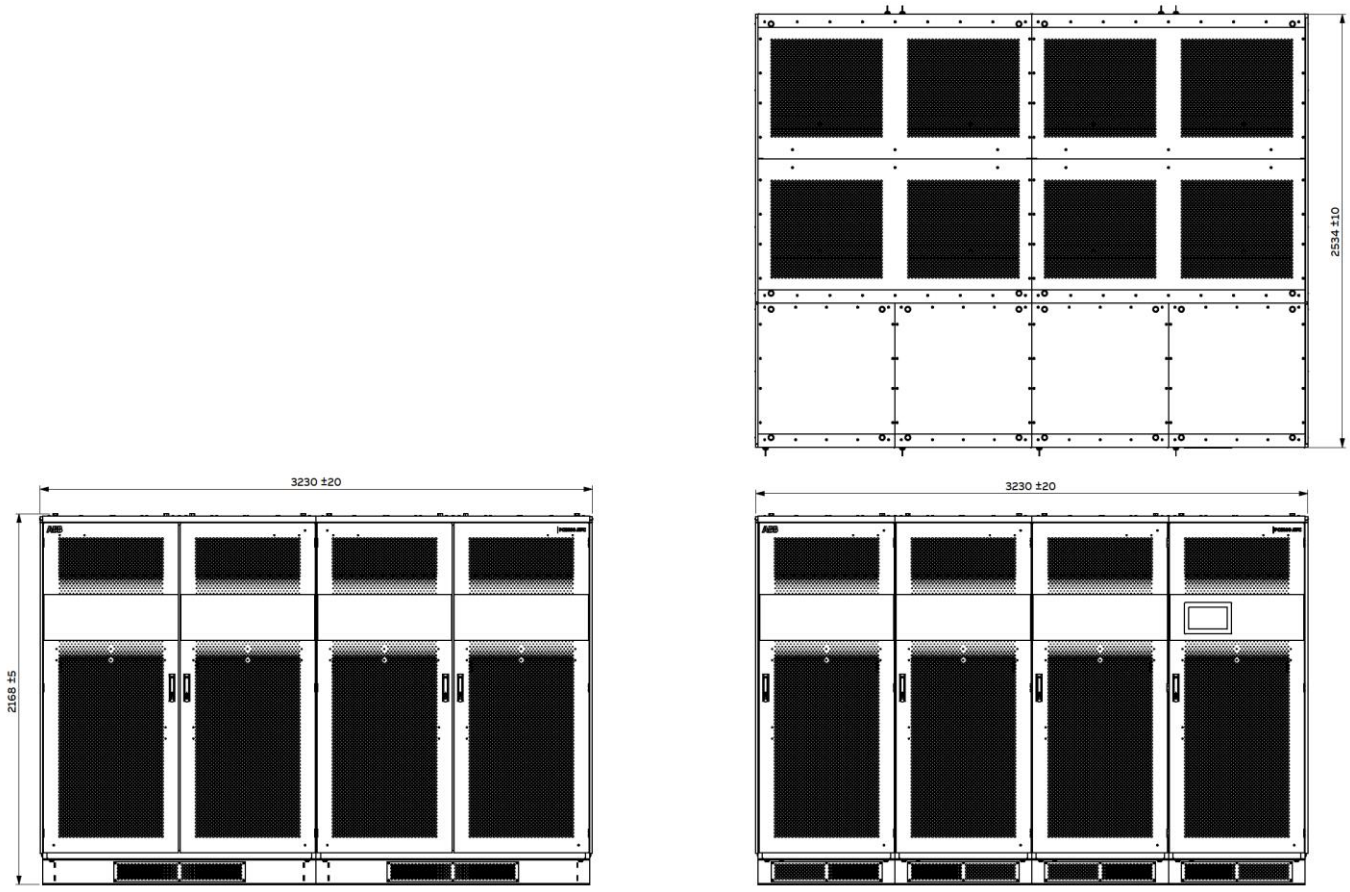


Figure 13-14: PCS100 AVC-40 8B, 10B and 12B frame size Back-to-Back layout

For 8B-12B models additionally to left and right access, the top entry cable option (T) is available. Top entry option comes with a “Roof Aperture” (+RA) as shown below. Those systems have two transformer cabinets. Each transformer cabinet offers top entry access if that option is chosen. Top entry cabling option and Roof Aperture will be defined by “-T” and “+RA” in the product type code. Example: PCS100 -07-480-10B-40-T+RA.

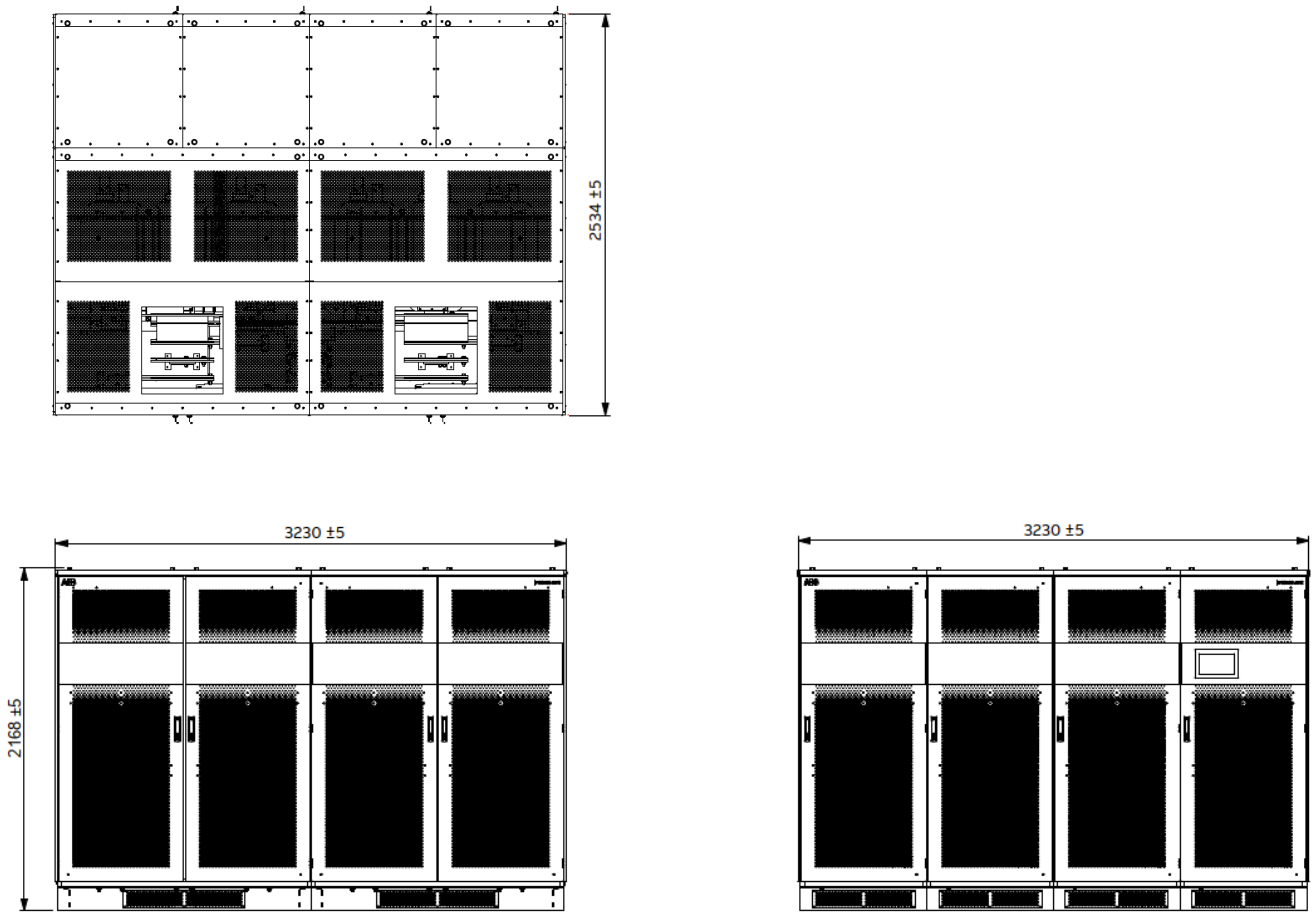


Figure 13-15: PCs100 AVC-40 8B-12B frame size Top Entry cable option layout.

14 PROTECTION REQUIREMENTS

14.1 Input Circuit Protection

14.1.1 Power system

The PCS100 is designed for use in TN (low impedance grounded neutral) power systems.

PCS100 may be safely applied to TT (resistance grounded) or IT (insulated neutral) power systems provided that appropriate additional protections are employed. Refer to ABB application note 2UCD070000E025 for further guidance on this subject.

14.1.2 Short circuit protection

The PCS100 AVC-40 connects between the power system supply and the load.

An upstream circuit breaker is required to protect the AVC-40 against short circuit faults.
The PCS100 AVC-40 is rated to be connected to power systems having fault capacity of the values shown in the following table. To provide discrimination time for downstream protection, short time withstand current rating (I_{CW}) for PCS100 AVC-40 is 2000% for 200 ms, however any fault current exceeding this value and less than or equal to the I_{CC} (interrupt rating/conditional short-circuit current) value shall be equipped with instantaneous tripping circuit breaker protection such as ABB Tmax XT series breakers.

Frame Size		**2B**	**3B**	**4B**	**5B**	**6B**	**8B**	**10B**	**12B**
Rated Power	kVA	600	900	1200	1500	1800	2400	3000	3600
220 V models, I_{cc}	kA	40	50	80	100	100	N/A	N/A	N/A
400 V models, I_{cc}	kA	31.5	31.5	40	50	63	65	65	65
480 V models, I_{cc}	kA	25	25	40	40	50	65	65	65
600 V/690 V models, I_{cc}	kA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	50

Table 14-1: PCS100 AVC-40 short circuit withstand ratings.

The PCS100 AVC-40 can sustain the fault currents listed above without damage and can be returned immediately to service following such a fault. Where higher fault currents occur, the system should be inspected for damage - service may be required.

14.1.3 Overload protection.

The upstream circuit breaker must provide overload protection to the AVC-40 and downstream loads. The breaker must be adjusted to trip within the thermal capability of the AVC-40 (or any faster downstream requirements).

If overloaded the AVC-40 will transition to bypass. The Bypass is rated to carry the following overload:

Maximum overload capacity (in bypass)	125% for 10 minutes 150% for 1 minute 500% for 1 s 2000% for 200 ms

The upstream circuit breaker overload settings must be set to operate within these times to protect the AVC-40, and instantaneously on any greater current.

14.2 Arc Fault Protection

14.2.1 Arc Fault and Standards

Arc faults may happen due to unexpected occurrences. Arcs can cause lethal injury from burns, pressure and flying debris. Generally, the risk is in proportion to the energy of the arc which is proportional to the fault current and time of exposure.

Safety issues in respect of arc faults are considered in the USA National Fire Protection Association NFPA 70E Standard for Electrical Safety in the Workplace. At this time there is no equivalent European standard. In the USA, NFPA 70E (and associated standards) mandates:

- Assessment of whether there are arc flash hazards (if the electrical equipment was de-energized, for example, the hazard would not be present)
- Calculation of the energy released by the arc, if present
- Determination of the flash protection boundary
- Provision of appropriate personal protective equipment (PPE) for the personnel working within the flash protection boundary
- Appropriately label the equipment. These warning labels are placed on the equipment by the plant owner and not by the manufacturer. The labels shall indicate the minimum protective distance, the energy level which can be released and the required personal protective equipment (PPE).

Such study is required for all US installations.

NFPA 70E Annex D (with reference to IEEE Standard 1584-2002 - IEEE Guide for Performing Arc Flash Hazard Calculations) provides guidance on calculation of fault energies, protection boundaries, PPE and labelling.

14.2.2 Arc Fault Protection Recommendation

Arc energy is proportional to current and time so protection must be designed to minimize both. Arc current may fall between 30% – 70% of the supply fault capacity. Molded case circuit breakers (MCCBs) or air circuit breakers (ACBs) should be used to promptly isolate energy sources in the event of an arc. Note – to ensure they clear instantaneously on occurrence of an arc, they must be set to trip immediately on currents of no more than 30% of the supply fault capacity. Fuses are generally not suitable as fast operation is not assured at the low overload currents arising in arcs.

14.2.2.1 MCCBs

Where available for the required load current (typically <1600 A), molded case circuit breakers (MCCBs) are the correct choice for protection of PCS100 AVC-40 systems. MCCBs, such as ABB Tmax series, use magnetic repulsion to clear fault currents of 10 -15 times the nominal current within about 6 ms. But note that below about 10 times the nominal current, the breakers revert to the electronic trip and are specified as taking < 40 ms to trip.

14.2.2.2 ACBs

Above about 1600 A, air circuit breakers (ACBs) are the only choice. These do not provide any sub-cyclic current limitation in short circuits. Typical ACBs can clear in 60 ms-80 ms, but the ABB Emax2 series is preferred as it can clear in only 40 ms. As with MCCBs, to minimize arc fault energy, it is critical to set instantaneous tripping under lowest expected arc current – no more than 30% of the supply fault capacity.

14.2.2.3 Fuses

Careful attention must be paid if choosing to use fuses for arc protection. Current limiting fuses are useful when the minimum arc current is in their current limiting range (e.g., 20 times or more). Fuses are not useful at reducing arc energy when the arc current is a low multiple of their rating (e.g., 10 times or less). When choosing fuses it is important to check that the melt time of the fuse is suitably short (e.g., 10 ms) under minimum arc current conditions. Note particularly in high current applications, fuse melt times are so long that fuses are unsuitable for providing arc fault protection.

14.2.2.4 MV side protection

MV side protection generally involves discrimination issues, the need to avoid tripping on transformer inrush, and much larger breakers with slower operating times. It is difficult to achieve clearing times of less than 100ms and typically 300 ms arise. If MV protection is employed much larger arc energy will arise.

14.2.3 Calculating ARC Energy

Various tools may be found online to calculate the arc energy according to NFPA 70E Annex D (with reference to IEEE Standard 1584-2002 - IEEE Guide for Performing Arc Flash Hazard Calculations) and the system design.
Once the energy is known, suitable keep out distances and/or personal protective equipment can be chosen.

14.2.4 Personal protective equipment

Personal protective equipment (PPE) should be worn in the vicinity of the PCS100 AVC-40. The PPE should be selected according to the calculated arc energy exposure. This should include clothing, footwear, eye and hearing protection according to the calculated energy level.
NFPA 70E sections (14) and (15) provide guidance on the selection of suitable personal protective equipment and ratings.
This can be summarized as:

Hazard Risk Category (HRC)	Incident Energy Minimum cal/cm2	Required FR Work Wear PPE
0	2	Non-melting Clothing
1	4	FR Shirt and FR Trousers (or FR Coveralls) and PPE
2	8	FR Shirt and FR Trousers (or FR Coveralls), Cotton Underwear and PPE
3	25	FR Shirt and FR Trousers, FR Coveralls (in addition to FR Shirt and FR Trousers), Cotton Underwear and PPE
4	40	FR Shirt and FR Trousers, FR Coveralls (in addition to FR Shirt and FR Trousers), Cotton Underwear, Full Coverage Arc Flash Suit and PPE

NFPA 70E does not have a Hazard Risk Category (HRC) above 40 cal/cm2. Working in environments above 40 cal/cm2 should be avoided because of the blast hazards caused by electric arc flash. Arc flash levels above 40 cal/cm2 can be fatal and usually result in a massive, pressurized blast with sound waves and projectiles. PPE is available for 100 cal/cm2 however the force from the pressurized blast can be fatal regardless of the PPE.

14.2.5 Keep out areas

For larger systems the potential arc energy is so high that PPE is not a practical solution. In this case a keep out area with barriers and labelling should be employed when the PCS100 AVC-40 is energized.

14.2.6 Labeling

Appropriate labels should be applied by the plant owner to warn of energy levels, PPE requirements and keep out zones.

14.2.7 Restricted area

The equipment must be applied in an area restricted to suitably trained personnel.

15 INSTALLATION REQUIREMENTS

15.1 Maintenance Bypass

ABB recommends that a maintenance bypass (not supplied with the PCS100 AVC-40) is fitted. The maintenance bypass allows maintenance to be performed on the PCS100 AVC-40 without disruption to the load.
ABB requires the input and output breakers of a maintenance bypass to be lockable for ABB service personnel to carry out any work on the PCS100 AVC-40. Please note that ABB LV breakers do not provide this as standard but as an option.
The PCS100 AVC-40 unit is designed to withstand significant short circuit current. Typical short circuit withstand ratings are summarized in the model tables and also in the table below. An upstream circuit breaker is required to protect the AVC-40 against short circuit faults.

15.2 Floor Requirements

All enclosures must be installed on a horizontal fireproof surface.
Do not exceed ± 0.2° change in slope between adjacent enclosures.
Do not exceed ± 5 mm in elevation between adjacent enclosures.

15.3 Electromagnetic Compatibility (EMC)

The PCS100 AVC-40 is designed for commercial and industrial applications. It is not suitable for connection to a low-voltage utility that is supplying residences unless additional measures are taken.
The PCS100 AVC-40 is rated to carry short duration fault currents to 2000% for 200 ms, and the upstream protection for small systems must be sized within this capability.
If required, the ABB factory can provide assistance with sizing appropriate protection. The PCS100 AVC-40 can sustain the fault currents listed above without damage and can be returned immediately to service following the fault. Where higher fault currents occur, service may be required following a downstream fault as an option.

15.4 Location

The PCS100 AVC-40 is designed for installation in a restricted access areas only.
The PCS100 AVC-40 is designed for connection by fixed wiring.
The PCS100 AVC-40 system should be located in a clean electrical room with a controlled environment temperature and humidity according to the requirements under the Technical Specification section.

15.5 Cooling

For PCS100 AVC-40 particular application losses for cooling system sizing please see the PCS100 AVC-40 model range tables in this Manual.

15.6 Power System

The PCS100 AVC-40 is designed for TN-S power system where the upstream transformer provides the neutral to the load may require. The PCS100 AVC-40 may be safely applied to TT (resistance grounded) or IT (insulated neutral power systems) provided that appropriate additional protections are employed. Consult the factory for use in other earthing system.

15.7 Harmonics

The PCS100 AVC-40 is designed to tolerate disturbances such as voltage and current harmonics in the load or supply. Excessive distortion causes increased component stress leading to reduction in the lifetime of the rectifier and inverter modules.
ABB recommends the harmonic contents on the input and the output of the system to meet IEC 61000-2-4 Class 2, THD_V up to 8%.
Contact the factory for THD_V > 8% as the lifetime of components may be affected.

15.8 Downstream Capacitor Banks

A care must be taken when installing the PCS100 AVC-40 with a capacitor bank downstream of the system. ABB recommends the capacitor bank to be installed upstream of the PCS100 AVC-40. Contact ABB for more information.

16 SERVICE AND TECHNICAL SUPPORT

16.1 ABB Power Conditioning provide global service and support of installation and commissioning of PCS100 products.

16.2 Comprehensive Global Services Portfolio

ABB services span the entire product ownership life cycle:

- Pre-purchase engineering
- Installation and commissioning
- Technical support
- Training
- Preventive and corrective maintenance and maintenance spare parts kits
- Retrofit and refurbishment.
- Globally available, supported by regional service hubs and operating in more than 100 countries.
- Spare part availability and stocking
- On-site repairs
- 24 x 365 local support line

16.3 Custom Tailored Service Contracts

- 24 x 365 local support line
- ABB services can be packaged into a custom service contract.
- Tailored to the specific needs of each customer.
- Contracts can be made at any stage of ABB product ownership.

Service contracts provide customers with improved cost controls, increased operational efficiency, lower capital expenditures, and extend ABB product lifetime.

16.4 Life Cycle Management

ABB's life cycle management model maximizes the value of the equipment and maintenance investment by maintaining high availability, eliminating unplanned repair costs, and extending the lifetime of the system. Life cycle management includes:

- Spare parts and expertise throughout the life cycle
- Efficient product support and maintenance for improved reliability
- Functionality upgrades to the initial product

16.5 Training

- Product training includes installation, commissioning, and maintenance.
- Training either at ABB Universities or at a customer site
- Training can be included in an ABB service contract.

16.6 Engineering And Technical Support

ABB's engineering team provides the necessary electrical, protective, and monitoring equipment, delivering a high level of energy continuity and superior power quality in a safe and cost-effective system. The PCS100 AVC-40 is available in several capacities, depending on the scope of application.

- Pre-purchase engineering to help select and integrate ABB PCS100 AVC-40 products.
- Customer assistance in sizing and modeling of systems
- Other life cycle engineering and technical support is available by phone, email, or on-site visits, or as agreed in an ABB service contract.
- Redundant internal bypass design increases reliability and availability and is part of a proven family of global ABB products.
- Scalable building block design

17 APPENDICES

17.1 General Disclaimer

The manufacturer shall have no obligation with respect to any product which (i) has been improperly repaired or altered; (ii) has been subjected to misuse, negligence, or accident; (iii) has been used in a manner contrary to the manufacturer's instructions; (iv) has failed as a result of ordinary wear and tear, or (v) has not been serviced and maintained as per the manufacturers maintenance schedule and associated procedures.

17.2 Recycling Information

The main parts of the product can be recycled to preserve natural resources and energy.
Product parts and materials should be dismantled and separated.
Generally, all metals such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard, and other packaging material can be used in energy recovery. Printed circuit boards and DC capacitors need selective treatment according to IEC 62635 guidelines. To aid recycling, plastic parts are marked with an appropriate identification code.
Contact your local ABB distributor for further information on environmental aspects and recycling instructions for professional recyclers. End of life treatment must follow international and local regulations.

17.3 Waste Electrical and Electronic Equipment Information (WEEE)

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste.
If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.
Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

17.4 Glossary

Term	Description
CB	Circuit Breaker
CGI	Common Gateway Interface. CGI software is used when passing data between the Vcan serial communications bus and the remote web pages.
CT	Current Transformer (sometimes means Coupling Transformer).
DSPE	Digital signal processing engine. Control processor board. Fits on top of the MSIB and VSIB
GDM	Graphic Display Module. The main HMI (Human Machine Interface) for the PCS100 products
GDMIB	Graphics Display Module Interface Board. A small circuit board inside the GDM. Its main function is an interface between Vcan and the GDM.
MSIB	Master Stack Interface Board (located in the master module)

Term	Description
NC	Normally closed (Relay)
NO	Normally open (Relay)
PCS100	A generic range of ABB LV power converter products.
PTC	Positive Temperature Coefficient temperature sensor.
SCM	System configuration manager. A small circuit board located inside the master module. When the PCS100 product powers up the SCM checks the SW revisions and the hardware configuration (i.e., the number of inverter and rectifier modules).
Vcan	The name of the high-speed serial communications bus protocol used by the different modules in the PCS100 products to communicate to each other. These modules are the Master Module, Inverter Module, Rectifier Module, SCM and GDM.
Vcanserver	The name of the driver software for the Vcan bus
VSIB	Slave Stack Interface Board (located in an inverter or rectifier module)
VT	Voltage Transformer or potential transformers (PT) for metering and protection in high/medium-voltage circuits

Table 17-1: Glossary

17.5 Open-Source Software

This product incorporates software from open-source communities. For more information please contact the factory.

17.6 Power Termination Details

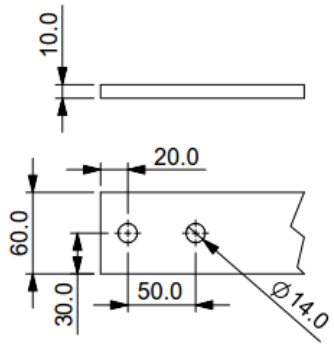
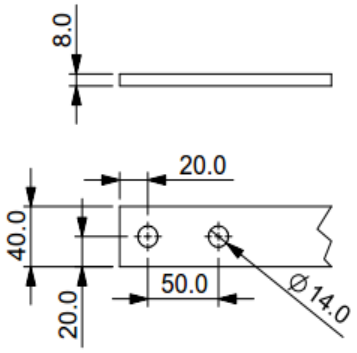
The following table and drawings define the PCS100 AVC-40 Injection Transformer terminations - Customer connections for supply and load. Following aberrations are used in descriptions:

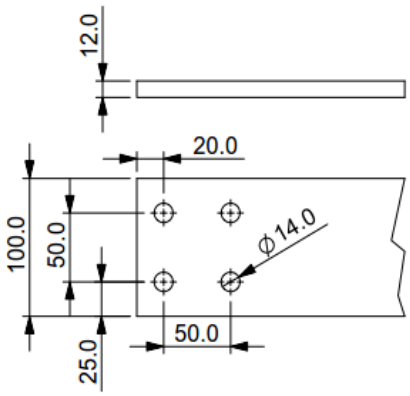
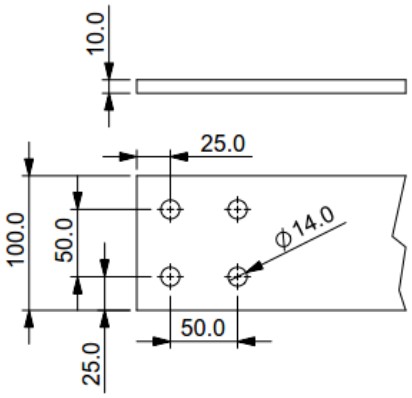
- TP Standard termination palm
- TPI IEC termination palm option
- TPN NEMA termination palm option

Note: For PCS100 AVC-40 systems larger than 6B, see the system Mechanical Layout drawing.

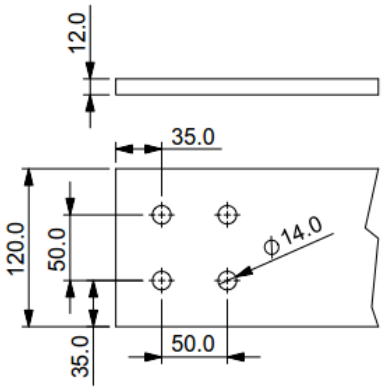
Power Modules	220 V	400/480 V	220 V+TPI	400/480 V+TPI	220 V+TPN	400/480 V+TPN
01B5	TP3	TP1	TPI3	TPI2	TPN3	TPN2
02B	TP3	TP1	TPI3	TPI2	TPN3	TPN2
02B5	TP5	TP4	TPI3	TPI3	TPN3	TPN3
03B	TP5	TP4	TPI3	TPI3	TPN3	TPN3
04B	TP5x2	TP5	TPI4	TPI3	TPN4	TPN3
05B	TP5x2	TP5	TPI4	TPI3	TPN4	TPN3
06B	TP5x2	TP5	TPI4	TPI3	TPN4	TPN3

Table 17-2: PCS100 AVC-40 termination details

TP1	**TP2**
	
Termination Details 6 x 60 mm x 10 mm (6 x 2.4'' x 0.4'') coated aluminum bar	Termination Details 6 x 40 mm x 8 mm (6 x 1.6'' x 0.3'') coated aluminum bar

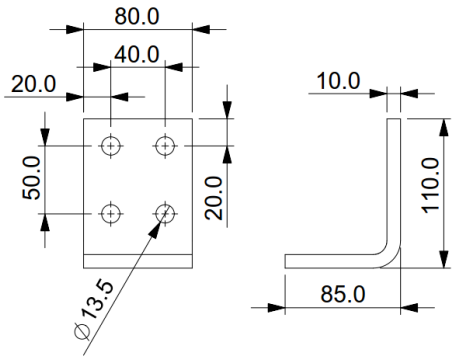
TP3	**TP4**
	
Termination Details 6 x 100 mm x 12mm (6 x 4'' x 0.48'') coated aluminum bar	Termination Details 6 x 100mm x 10 mm (6 x 4'' x 0.4'') coated aluminum bar

TP5



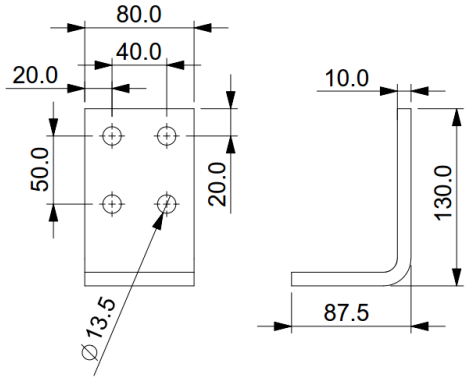
Termination Details
6 x 120mm x 12 mm (6 x 4.8'' x 0.48'') coated aluminum bar

TPI1



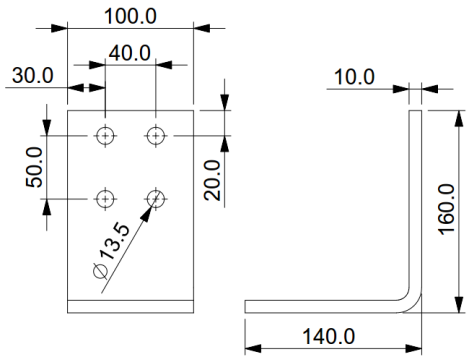
Termination Details
1. 6 x 80 mm x 90 mm (6 x 3.2'' x 3.6'') Palm (10mm (0.4'') copper)

TPI2



Termination Details
2. 6 x 80 mm x 110 mm (6 x 3.2'' x 4.4'') Palm (10mm (0.4'') copper)

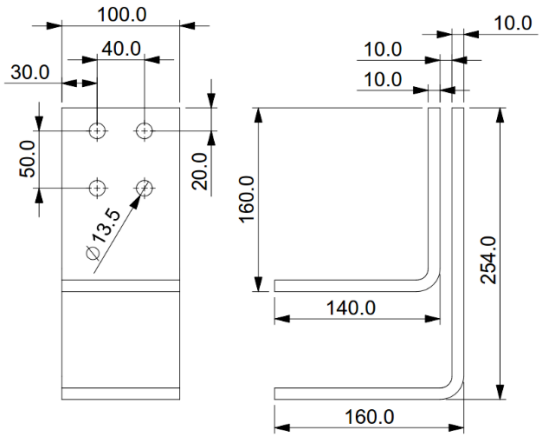
TPI3



Termination Details

1. 6 x 100 mm x 140 mm (6 x 4'' x 5.5'') Palm (10mm (0.4'') copper)

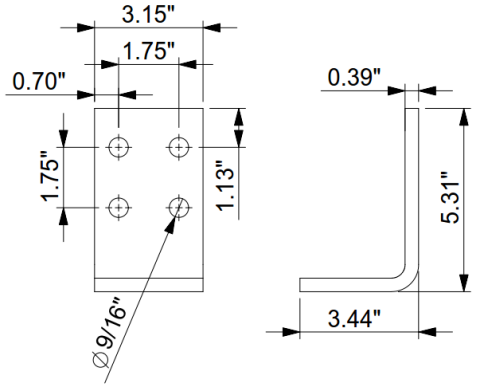
TPI4



Termination Details

2. 6 x 100 mm x 140 mm (6 x 4'' x 5.5'') (10mm (0.4'') copper x 2)

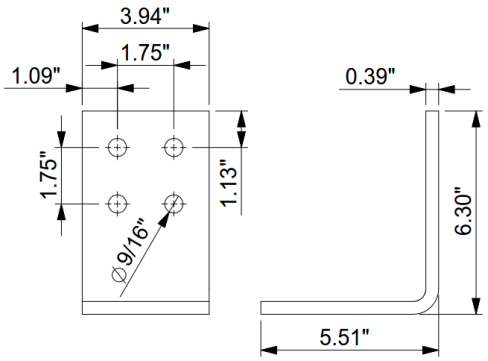
TPN2



Termination Details

6 x x80mm x 110mm (6 x 3.15" x 4.33") Palm (9.91mm (0.39") copper)

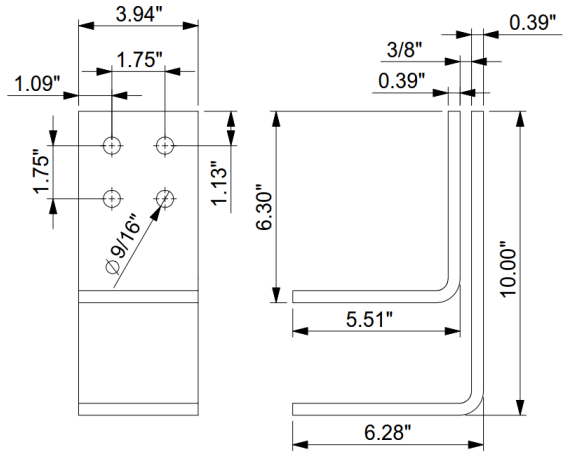
TPN3



Termination Details

6 x 100mm x 140mm (6 x 3.94" x 5.51") Palm (9.91mm (0.39") copper)

TPN4



Termination Details
6 x 100mm x 140mm (6 x 3.94" x 5.51") Palm
(9.91mm (0.39”) copper x 2)

17.7 Torque settings and Bolt order.

The following table shows torque settings recommended for the power cable connections.

Tightening Torque for Standard Bolts and Nuts

Bolt Size	**Pitch [mm (inch)]**	**Torque [Nm (lbf ft)]** Note: For replacement use only high tensile bolts
M5	0.8 (0.03”)	4.5 (3.6)
M6	1.0 (0.04”)	7.2 (5.3)
M8	1.0 (0.04”)	16 (11.8)
M10	1.25 (0.05”)	28 (20.7)
M12	1.75 (0.07”)	45 (33.2)

Table 17-3: Tightening torques.

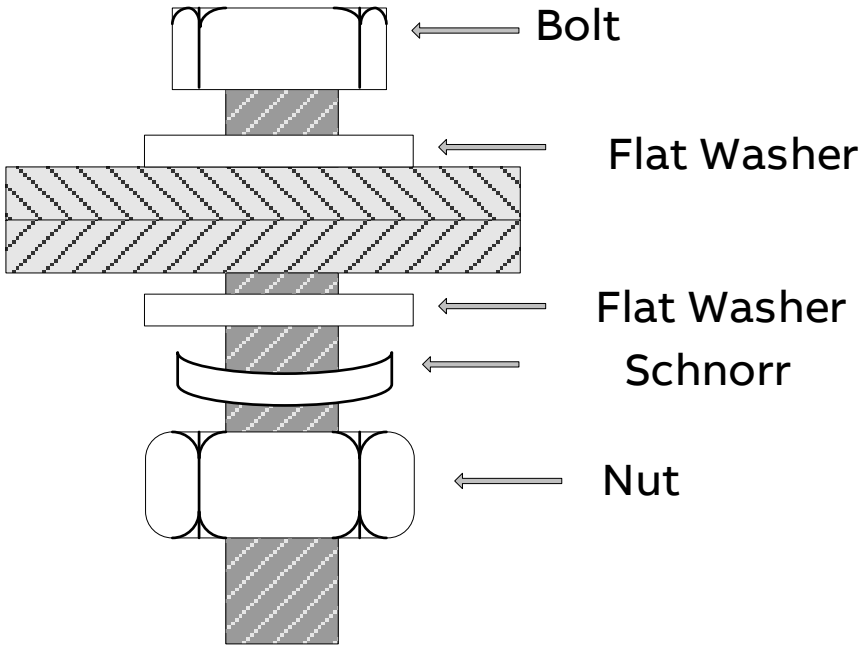


Figure 17-1: Bolt order.

17.8 PCS100 AVC-40 Bypass Overload Capacity

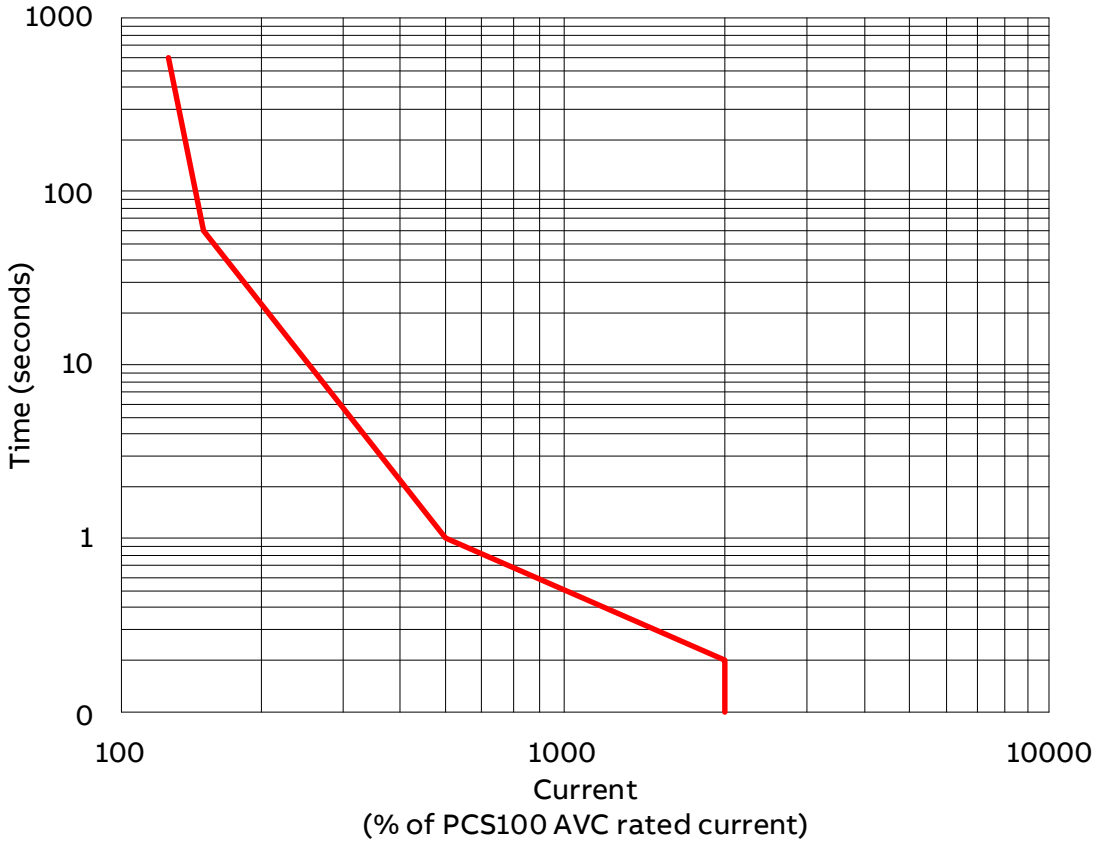


Figure 17-2: PCS100 AVC-40 Bypass overload capacity.

18 ADDITIANL INFORMATION

18.1 Related Documents

Document Number	Document Name
2UCD074000E002	PCS100 AVC-40 Technical Catalogue (450 kVA – 3600 kVA)
2UCD070000E401	PCS100 AVC Service Guide 1B
2UCD070000E402	PCS100 AVC Service Guide 2B
2UCD070000E403	PCS100 AVC Service Guide 3B
2UCD070000E404	PCS100 AVC Service Guide 4B to 6B
2UCD070000E020	PCS100 AVC Detailed Performance Curves
2UCD074000E003	PCS100 AVC-40 Installation Checklist
2UCD074000E004	PCS100 AVC-40 Commissioning Checklist
2UCD200000E001	How to View the GDM Remote Web Pages
2UCD200000E002	How to Upgrade System Software over Ethernet
2UCD200000E430	PCS100 SCM Diagnostics
2UCD074000E410	PCS100 AVC-40 Maintenance Schedule
2UCD070000E025	AVC in TT Power Systems AN
2UCD200000E007	PCS100 Environment Specification
2UCD074000E412	PCS100 AVC-40 Annual Maintenance Plan

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