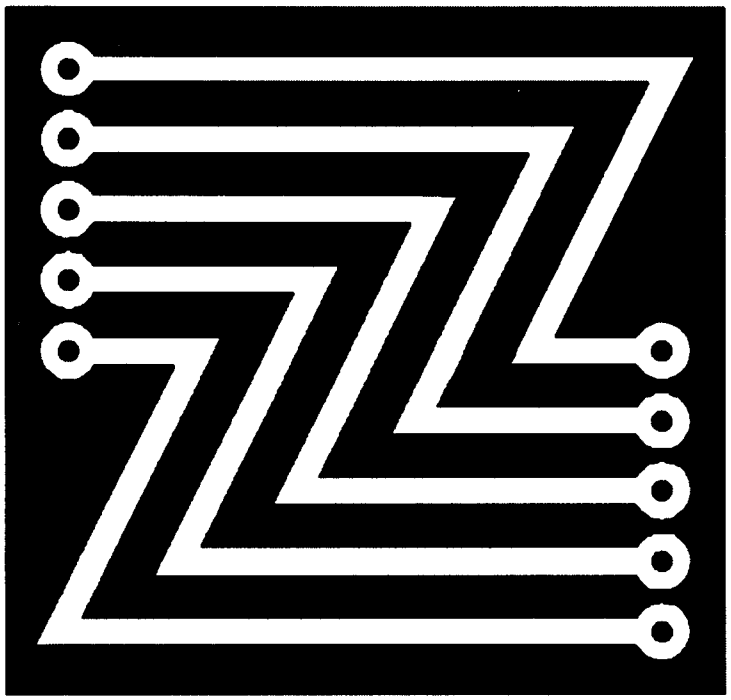


ZENER

VSC

INSTRUCTION MANUAL

ZENER TECHNOLOGY AND QUALITY ASSURANCE

Since 1978 Zener Electric has supplied many thousands of AC drives to Australian Industries. These drives have been installed into numerous applications resulting in a wealth of in house experience.

The Zener VSC AC motor variable speed controller is the culmination of this expertise, modern technology and industrial applications requirements.

The Zener Quality Assurance program ensures that every VSC manufactured has proven to operate correctly in the production test bay before dispatch.

VSC PRODUCT WARRANTY

Zener Electric warrants the VSC against defective workmanship and materials for a period of 24 months from the date of dispatch. Such defects will be rectified free of charge for both labour and material, at Zener Electric's premises subject to:

1. Zener Electric's customer raising an order upon Zener for service and or repairs, subject to a warranty claim. The order is to state particulars of the model and serial number, the date of original purchase and invoice/delivery docket number.
2. All damage resulting from incorrect installation or use other than in accordance with the Instruction Manual issued by Zener Electric is excluded from this warranty.
3. The Warranty being rendered invalid if the product is misused or if any unauthorized alteration, modification or substitution of any part of the product be made or the serial number of the product is defaced or altered.
4. The cost of transportation (both ways) is to be met by the owner if it is necessary to return the product, or any part of it, to Zener Electric's premises.
5. A charge being accepted by the owner for travelling time and expenses incurred in connection with warranty service at the user's site as requested by the owner.
6. If the product was not purchased from Zener Electric directly, then a warranty claim must be lodged with the original supplier in the first instance. Repairs will not be effected by Zener Electric unless approved by the original supplier.
7. Goods not of our own manufacture incorporated in our supply or merchanted by us, carry their maker's warranty only.
8. Goods returned for claim under warranty will be accepted on the condition that should the claim be rejected then all costs, including inspection, will be charged to the customer's account.

SAFETY

Your VSC must be applied, installed and operated in a safe manner. It is the responsibility of the user to ensure compliance with all regulations and practices covering the installation and wiring of your VSC. This Instruction Manual should be completely read and understood before attempting to connect or operate the VSC. Only skilled personnel should install this equipment.

THE CONTENTS OF THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE

TABLE OF CONTENTS

VSC MODEL NUMBERS

High Performance	General Purpose	Single Phase	Full Load Current
VSC-H3			2.5 A
		VSC-S3	2.9 A
VSC-H4		VSC-S4	4.0 A
VSC-H5		VSC-S5	5.0 A
VSC-H10			10.0 A
VSC-H13	VSC-G13		13.0 A
VSC-H17	VSC-G17		17.5 A
VSC-H24	VSC-G24		24.0 A
VSC-H32	VSC-G32		32.0 A
VSC-H38	VSC-G38		38.0 A
VSC-H44	VSC-G44		44.0 A
	VSC-G60		60.0 A

VSC General Specifications

INPUT POWER SUPPLY

VSC-S Single Phase Supply plus Earth
VSC-G Three Phase Supply plus Earth
VSC-H Three Phase Supply plus Earth

INPUT VOLTAGE

VSC-S 220 to 240 Vac
VSC-G 415 OR 460 Vac OR Multi Input
VSC-H 415 OR 460 Vac OR Multi Input
Multi Input=346/380/415/440 Vac

INPUT VOLTAGE TOLERANCE

+10% to −15% of nameplate voltage
+20% for one mains cycle

INPUT FREQUENCY

Either 50 Hz OR 60 Hz

OUTPUT SUPPLY

Three Phase Supply plus Earth

OUTPUT VOLTAGE

0 to 100% of nameplate Input Voltage

OUTPUT FREQUENCY

Switch Selectable Frequency Ranges
Minimum: 1 Hz
Maximum: 50, 75, 100 Hz (60, 90, 120 Hz)

SPEED INPUT SIGNALS

Potentiometer (135 ohms to 5000 ohms)
0 to 10 Vdc (Rin=10,000 ohms)
1 to 5 Vdc (Rin=100,000 ohms)
4 to 20 mA DC (Rin=250 ohms)
Speed signals may either be differential or earth referenced.

ACCELERATION/DECELERATION TIMES

Accel and Decel times are independently adjustable within one of two ranges:
0.75 to 15 seconds or 7.5 to 150 seconds
(continuously adjustable within each range)

SLIP COMPENSATION

Automatically adjusts output frequency and voltage as motor speed changes due to load variation. This provides improved speed regulation with large changes in motor load.

Speed regulation: 0 to 100% Load Variation:

For an 82% efficient motor, typically:
3.3:1 Turn Down (15 to 50 Hz) ±1.00%
5.0:1 Turn Down (10 to 50 Hz) ±1.25%

For a 92% efficient motor, typically:
5:1 Turn Down (10 to 50 Hz) ±0.5%
10:1 Turn Down (5 to 50 Hz) ±1.0%

At a set speed: typically ±0.1%

Reaction Time: nominally 1 second

RATED CURRENT

Refer to the table of VSC Model Numbers on page one for the rated current of each VSC model.

START BOOST

Continuously adjustable within one of four switch selectable ranges:
Low, Normal, Medium and High.

FLUX COMPENSATION

Automatically reduces motor voltage (flux) in proportion to motor load. This allows energy savings in applications where the motor is not always fully loaded.

SPEED OUTPUT SIGNAL

0 to 10 Vdc=0 to 100 Hz (5V=50 Hz)
0 to 10 Vdc=0 to 120 Hz (60 Hz Input)

LOAD OUTPUT SIGNAL

0 to 6.7 Vdc=0 to 100% Load (nominally)

FREQUENCY RESOLUTION

Continuously Variable

FREQUENCY STABILITY

175 parts per million/°C

PROTECTIVE CIRCUITS WITH LED INDICATION

Earth Fault, Short Circuit, Over Current, Under Voltage, Over Voltage, Over Temperature, Remote Trip.

STATUS INDICATION

Power On, Zero Speed, Enabled, Forward, Reverse, Accel Limit, Decel Limit, Driver Modules.

CONTROL TECHNIQUE

Sine Wave Coded Pulse Width Modulation

STOP/START CONTROL

Electronically controlled by contact closure. Contacts must be voltage free.

FORWARD/REVERSE CONTROL

Electronically controlled by contact closure. Contacts must be voltage free.

ACCEL LIMIT CIRCUIT

Increases acceleration time to avoid nuisance Over Current tripping.

DECEL LIMIT CIRCUIT

Increases deceleration time to avoid nuisance Over Voltage tripping.

AMBIENT TEMPERATURE RANGE

Operating: 0°C to 50°C
Storage: −20°C to 70°C

ISOLATION

Terminals 12 and 13 on the VSC Control Board are internally connected to EARTH.

LINEARITY

Linearity between speed input signal and output frequency is 0.3%.

RECEIVING

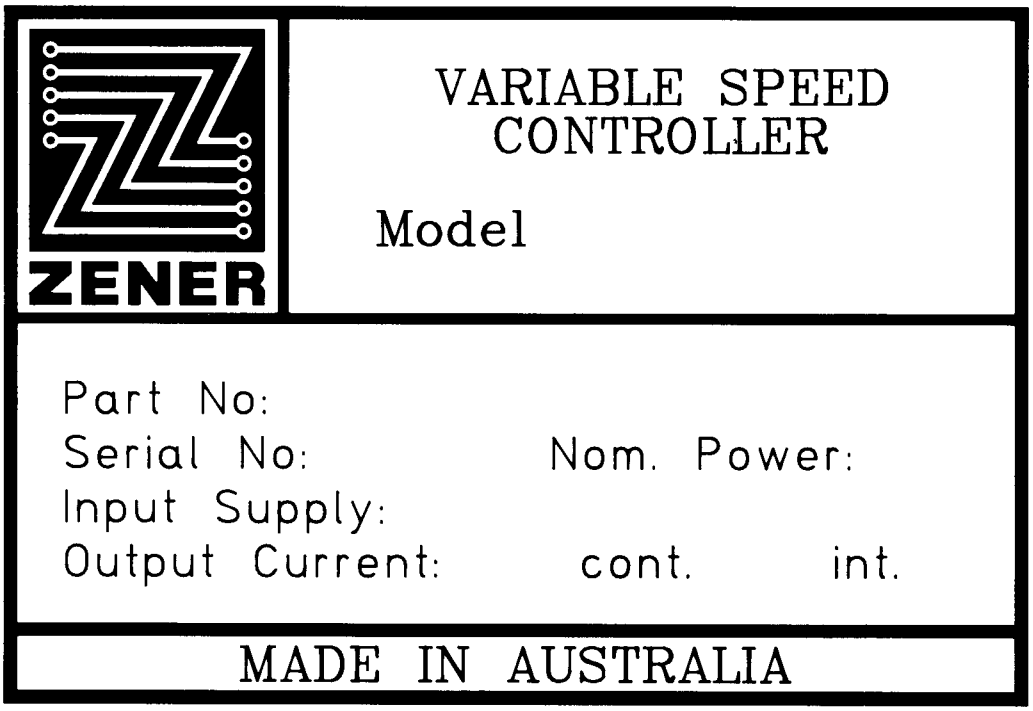
Inspect the VSC for shipping damage. If any damage is found, report it to the carrier immediately. Access the inside of the controller and check for any visual damage. DO NOT ATTEMPT TO OPERATE THE CONTROLLER IF ANY VISUAL DAMAGE EXISTS. Check all connectors and relays to be sure they are locked securely in place.

After the initial inspection, the VSC may be re-packed and stored in a clean dry location until you are ready to use it. DO NOT store this equipment in any area where the ambient temperature will rise above 70°C or drop below –20°C. DO NOT store this equipment in areas of high condensation or corrosive atmosphere. Proper storage is necessary to ensure satisfactory controller start-up and performance.

The information contained in this manual is sufficient for installation and start-up of the VSC in most applications. For complete details regarding applications, selection, operation, commissioning and trouble shooting please refer to the VSC Applications Manual and the VSC Service Manual.

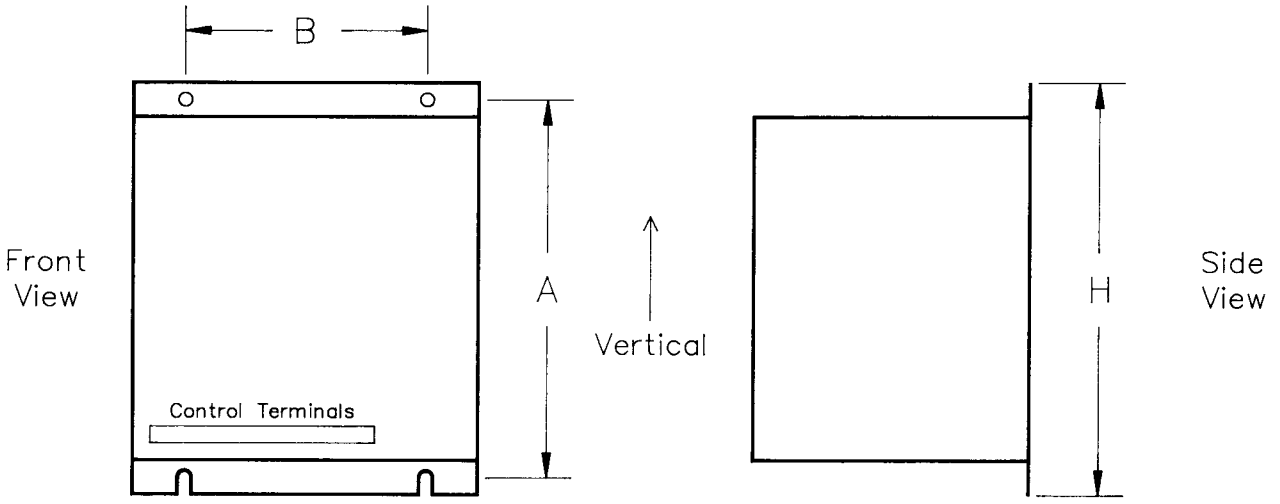
VSC IDENTIFICATION

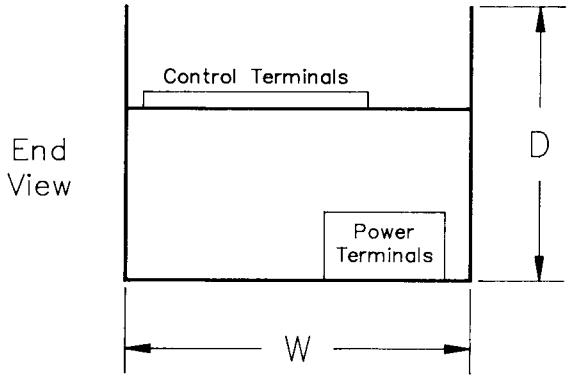
Locate the VSC Name Plate on the inside of the VSC chassis. The drawing below is an example of this name plate.



Use this drawing to note the relevant details of your VSC. The Input Voltage and Model Number of your controller are important and you will need to know them for proper installation.

VSC Chassis Mechanical Installation and Physical Dimensions





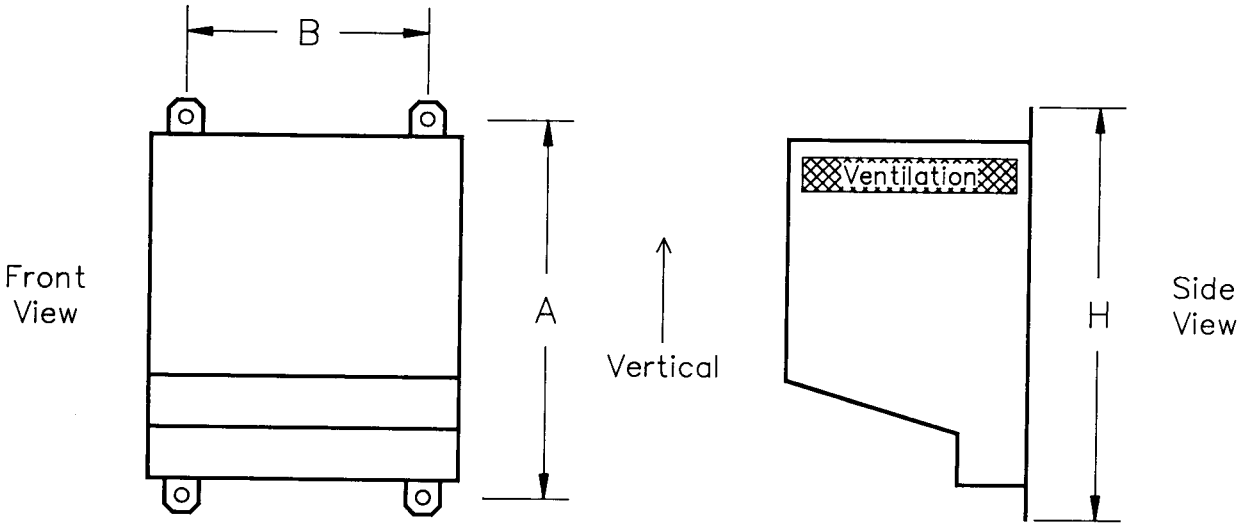
1. All dimensions are in mm.
2. Mounting holes are 8mm diameter.
3. Dimension tolerance: ±1mm.
4. DO NOT allow swarf or any other conductive material to enter the chassis or damage may result.

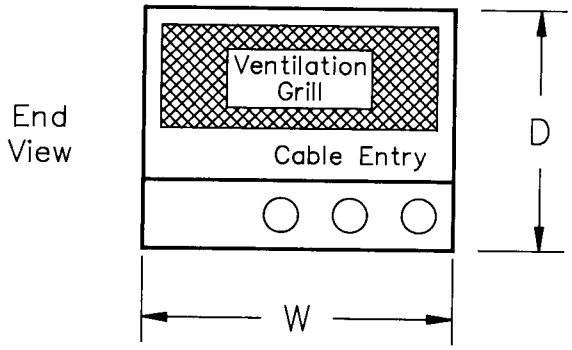
READ THIS FIRST

1. The chassis must be mounted in a Clean, Dry, Vibration Free location.
2. Protect the chassis against dust, corrosive gases and liquid sprays.
3. Operating Temperature: 0°C to 50°C.
4. Mount the chassis vertically, away from heat radiating sources.
5. Allow 100 mm above and below the chassis for ventilation.
6. If the chassis is mounted inside an enclosure, heat dissipation must be allowed for. Plastic enclosures are NOT recommended due to their poor heat dissipation. Refer to the VSC Applications Manual for details.

Model Number	H mm	W mm	D mm	A mm	B mm	Weight kg
VSC–S3	305	265	196	285	185	5
VSC–S4	305	265	196	285	185	8
VSC–S5	305	265	196	285	185	9
VSC–G13	305	265	196	285	185	9
VSC–G17	380	385	196	360	230	14
VSC–G24	380	385	196	360	230	14
VSC–G32	380	385	196	360	230	14
VSC–G38	380	385	196	360	230	14
VSC–G44	600	385	260	580	230	28
VSC–G60	600	385	260	580	230	32
VSC–H3	305	265	196	285	185	5
VSC–H4	305	265	196	285	185	8
VSC–H5	305	265	196	285	185	9
VSC–H10	305	265	196	285	185	9
VSC–H13	305	265	196	285	185	9
VSC–H17	380	385	196	360	230	14
VSC–H24	380	385	196	360	230	14
VSC–H32	380	385	196	360	230	14
VSC–H38	600	385	260	580	230	28
VSC–H44	600	385	260	580	230	28

VSC Enclosure Mechanical Installation and Physical Dimensions





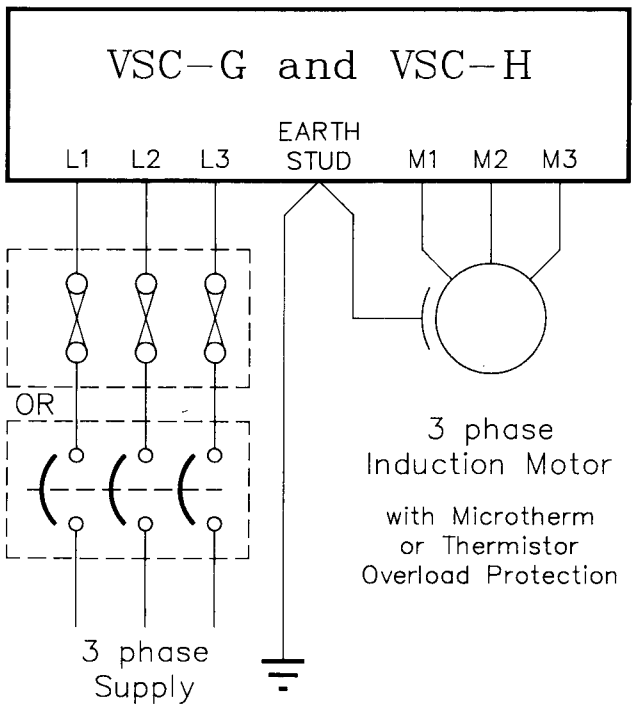
1. All dimensions are in mm.
2. Mounting holes are 8mm diameter.
3. Dimension tolerance: ±1mm.
4. Do not allow swarf or any other conductive material to enter the enclosure or damage may result.

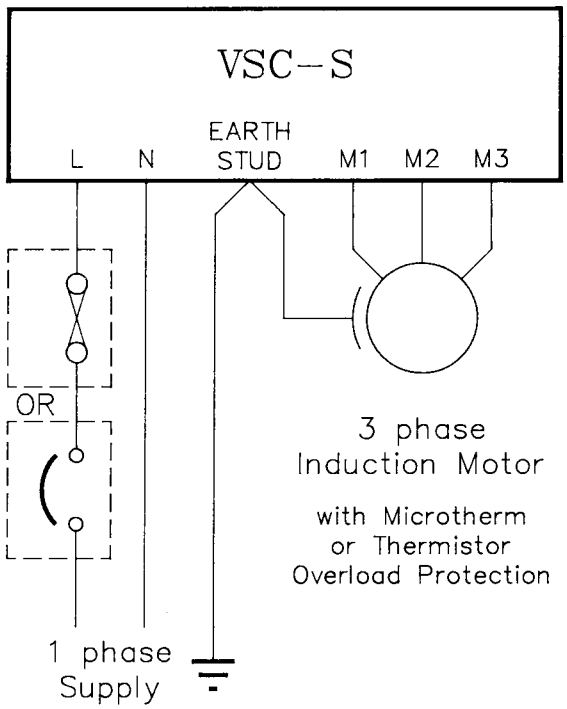
READ THIS FIRST

1. The VSC enclosure must be mounted in a Vibration Free location.
2. Protect the enclosure against dust build–up and dripping or sprayed liquids.
3. Operating Temperature: 0°C to 50°C.
4. Mount the enclosure vertically away from heat radiating sources.
5. Allow 100mm above, below and either side of the enclosure for ventilation.
6. Do not mount the enclosure in direct sunlight or on hot surfaces.
7. If the enclosure is mounted inside another enclosure, the total heat dissipation must be allowed for. Refer to the VSC Applications Manual.

Model Number	H mm	W mm	D mm	A mm	B mm	Weight kg
VSC–S3	445	280	200	420	185	8
VSC–S4	445	280	200	420	185	11
VSC–S5	445	280	200	420	185	12
VSC–G13	445	280	200	420	185	12
VSC–G17	520	400	200	495	230	19
VSC–G24	520	400	200	495	230	19
VSC–G32	520	400	200	495	230	19
VSC–G38	520	400	200	495	230	19
VSC–G44	920	400	265	890	230	35
VSC–G60	920	400	265	890	230	39
VSC–H3	445	280	200	420	185	8
VSC–H4	445	280	200	420	185	11
VSC–H5	445	280	200	420	185	12
VSC–H10	445	280	200	420	185	12
VSC–H13	445	280	200	420	185	12
VSC–H17	520	400	200	495	230	19
VSC–H24	520	400	200	495	230	19
VSC–H32	520	400	200	495	230	19
VSC–H38	920	400	265	890	230	35
VSC–H44	920	400	265	890	230	35

VSC Power Wiring Diagram





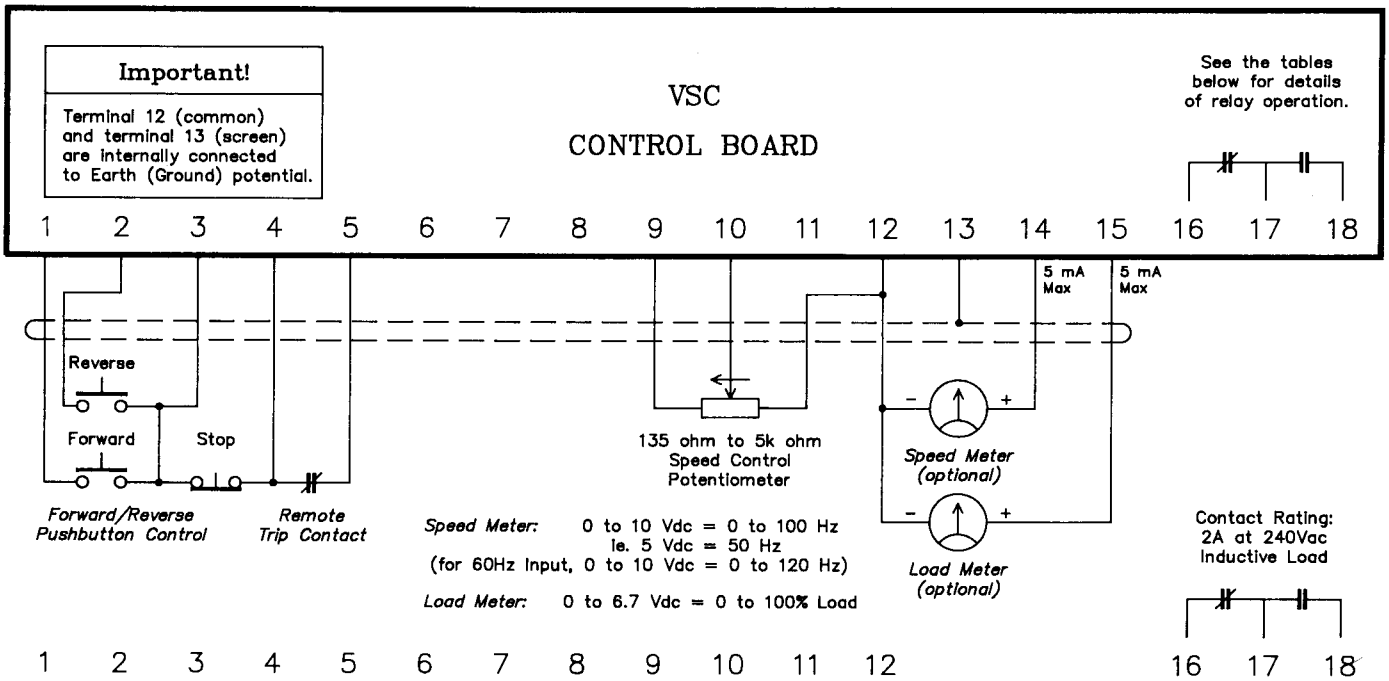
Recommended Fuse and Circuit breaker Ratings

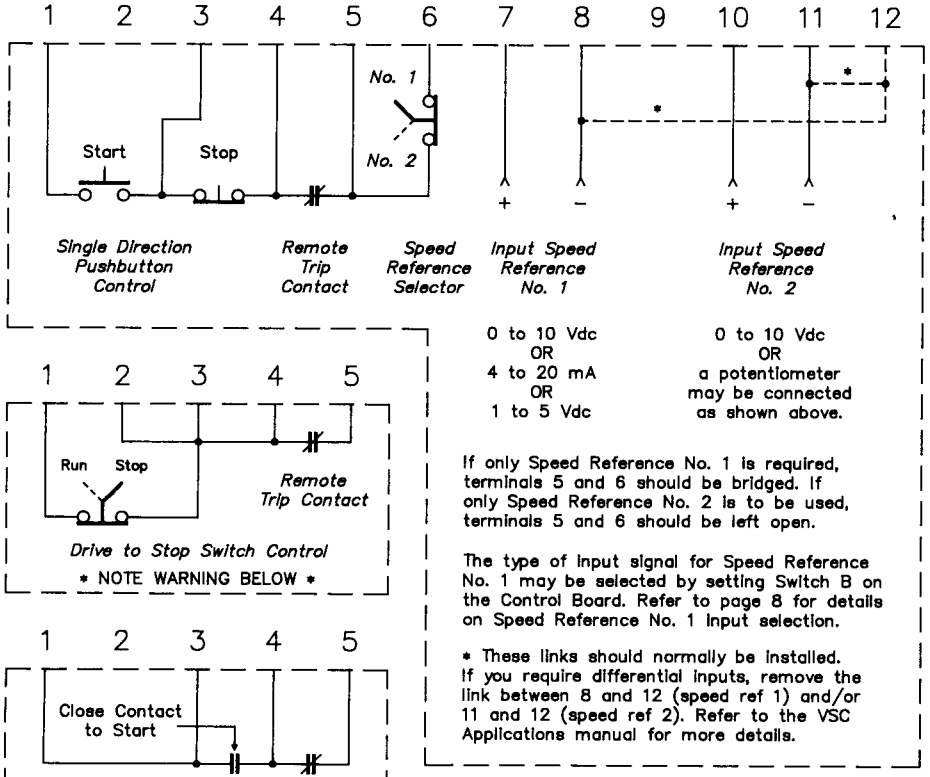
Model Number	Input Current		Fuse or C/B Rating
	Continuous	Intermittent	
VSC–S3	4.8 A	7.2 A	10 A
VSC–S4	6.6 A	9.9 A	10 A
VSC–S5	8.3 A	12.5 A	16 A
VSC–G13	14.3 A	15.7 A	16 A
VSC–G17	19.3 A	21.2 A	32 A
VSC–G24	26.4 A	29.1 A	32 A
VSC–G32	35.2 A	38.7 A	40 A
VSC–G38	41.8 A	46.0 A	63 A
VSC–G44	48.4 A	53.3 A	63 A
VSC–G60	66.0 A	72.6 A	80 A
VSC–H3	2.8 A	4.2 A	6 A
VSC–H4	4.4 A	6.6 A	10 A
VSC–H5	5.5 A	8.3 A	10 A
VSC–H10	11.0 A	16.5 A	20 A
VSC–H13	14.3 A	21.5 A	32 A
VSC–H17	19.3 A	28.9 A	32 A
VSC–H24	26.4 A	39.6 A	40 A
VSC–H32	35.2 A	52.8 A	63 A
VSC–H38	41.8 A	62.7 A	63 A
VSC–H44	48.4 A	72.6 A	80 A

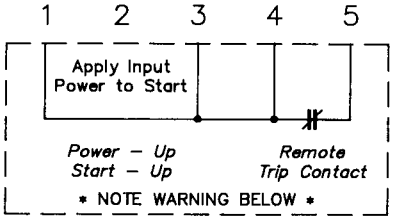
READ THIS FIRST

1. Power Input and Output terminals are located in the bottom right hand corner of the controller.
2. EITHER Fuses OR a Circuit Breaker should be connected as shown above.
3. Locate the VSC Name Plate and check the Input Voltage BEFORE connecting mains power.
4. Microtherms or Thermistors should be installed in the motor for overload protection. Refer to the VSC control wiring diagram for trip contact connection details.
5. Input Voltage tolerance is −15% to +10% of nameplate value.
6. Do not connect contactor or relay coils to the VSC output terminals.
7. Cable sizes should be selected according to local codes or standards. The Input Current table may be used for cable selection.

VSC Control Wiring Diagram







*** WARNING ***

If the input power is interrupted, or the Remote Trip contact is reset, then an Undesired Start Up may occur.

Remote Trip Contact:

Normally a motor overload device such as a Thermistor Relay or a Microtherm would be connected to terminals 4 and 5 as shown. If this contact is opened, the VSC will be disabled and the Remote Trip Led will illuminate. If it is unused, terminals 4 and 5 should be linked.

Shielded Cable:

Shielded Cable must be used for all wiring to terminals 1 through 15.

Control Circuit Contact Rating:

24 Vdc at 0.1 A

No Input Power	Closed	Open
Power On, No Fault	Open	Closed
Power On Fault Detected	Closed	Open

FAULT MODE

No Input Power	Closed	Open
Power On, Zero Speed	Closed	Open
Power On, Speed > Zero	Open	Closed

ZERO SPEED MODE

No Input Power	Closed	Open
Power On, Drive Stopped	Closed	Open
Power On, Drive Enabled and Direction Selected	Open	Closed

RUN MODE

VSC Adjustment Locations and Initial Settings

Switch A

1 2	Run Mode	Status Relay Mode
1 2	Fault Mode	
2 1	Zero Speed Mode	
3 4	*Standard Motors inc. Overdrive*	* *Volts/Hertz Ratio*
4 3	*Non Standard Motors*	
3 4	*Non Standard Motors*	
5	*Not Fitted*	* *Braking Module Option*
5	*Fitted*	
6 7 8	High	Start Boost Range
8 6 7	Medium	
7 6 8	Normal	
6 7 8	Low	

Switch B

1 2	50 Hz (60 Hz)	Ouput Frequency Selection
1 2	75 Hz (90 Hz)	
2 1	100 Hz (120 Hz)	
5	15 – 150 seconds	Accel/Decel Range (time to go from 1 Hz to 50 Hz)
5	0.75 – 15 seconds	
6 7 8	1 – 5 Vdc	**Input Speed Reference No. 1 Selection**
6 7 8	0 – 10 Vdc	
6 7 8	4 – 20 mA	

*

Status Relay Mode, Output Frequency, Accel/Decel Range, Speed Reference No. 1 and Start Boost Range may be re–selected to suit your application. However, refer to the VSC Applications Manual before changing the Volts/Hertz Ratio or the Braking Module Option selections.

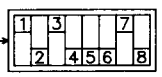
The Start Up procedure in this manual will guide you through the Customer Adjustments and final Switch selections.

Application Selection Switches

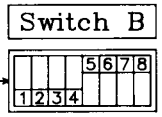
Switch positions shown here are for standard operation.

See the tables above for alternative switch selection.

Switch A



Switch B

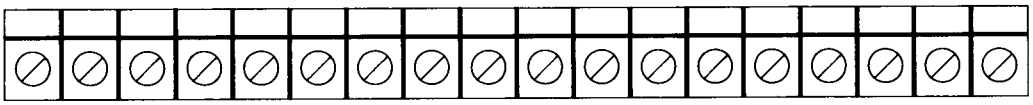


Customer Adjustments

Min Speed	Max Speed	Accel Time	Decel Time	Start Boost	V/Hz	Flux Comp	Slip Comp	Current Limit
0%	100%	50%	50%	25%	70%	0%	0%	100%

Initial Settings

0% = fully counter–clockwise
100% = fully clockwise



VSC Instruction Manual Supplement
IM00013C

Introduction

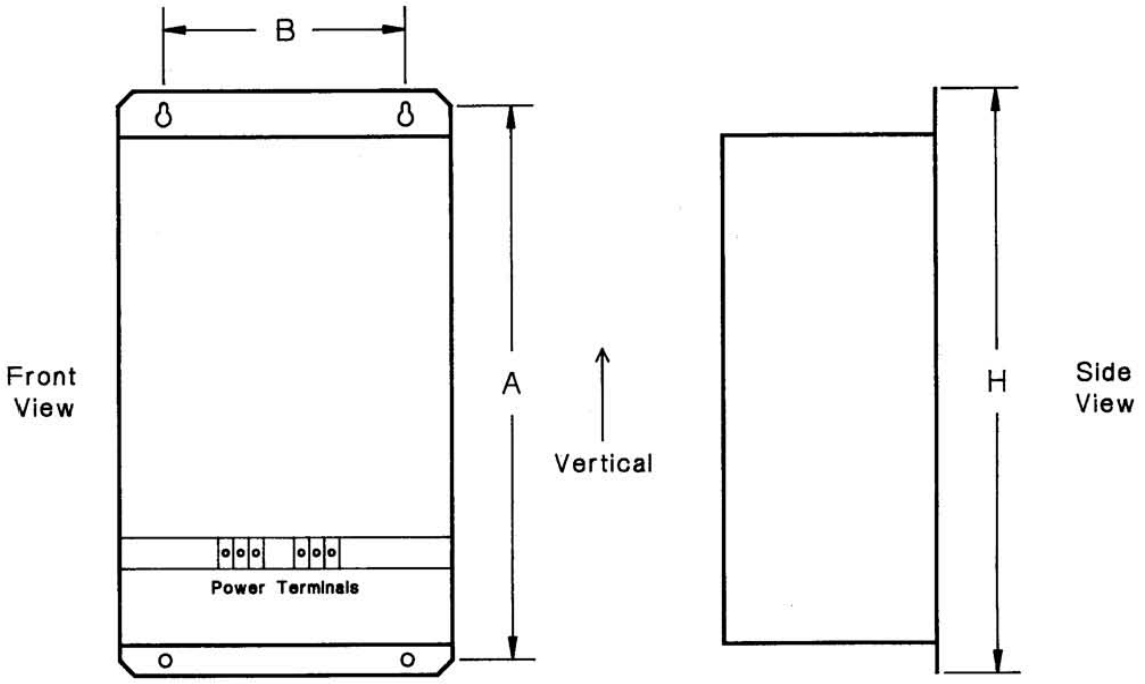
This supplement provides additional information covering the new VSC models listed below. Only the mechanical details and power wiring connections have been affected. All other information can be found in the VSC Instruction Manual, IM00002, which must be read in conjunction with this supplement.

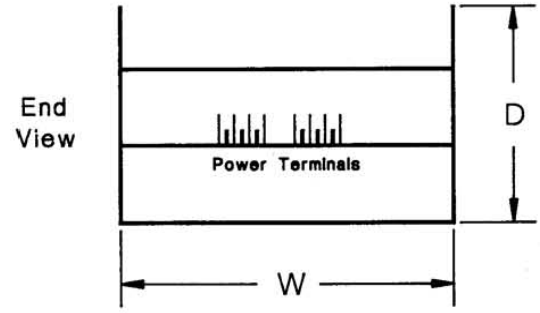
VSC Model Numbers

High Performance	General Purpose	Full Load Current
VSC-H60		60 A
VSC-H73	VSC-G73	73 A
VSC-H86	VSC-G86	86 A
VSC-H102	VSC-G102	102 A
VSC-H140	VSC-G140	140 A
VSC-H170	VSC-G170	170 A
VSC-H205	VSC-G205	205 A
VSC-H240	VSC-G240	240 A
	VSC-G280	280 A
	VSC-G327	327 A

Contents

VSC Chassis Mechanical Installation and Physical Dimensions - Supplementary





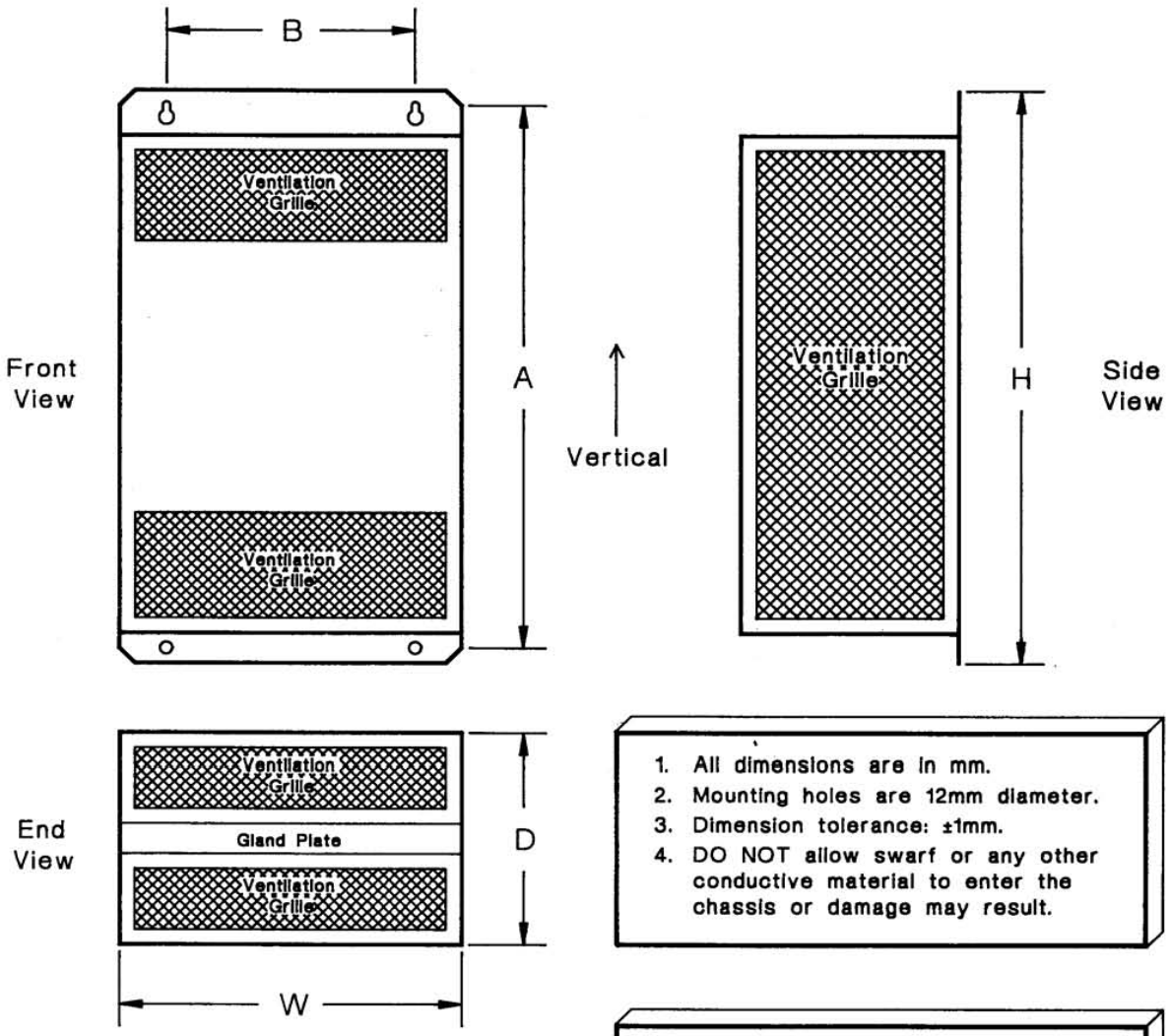
1. All dimensions are in mm.
2. Mounting holes are 12mm diameter.
3. Dimension tolerance: ±1mm.
4. DO NOT allow swarf or any other conductive material to enter the chassis or damage may result.

Model Number	H mm	W mm	D mm	A mm	B mm	Weight kg
VSC-G73	970	550	380	930	400	72
VSC-G86	970	550	380	930	400	73
VSC-G102	970	550	380	930	400	77
VSC-G140	970	550	380	930	400	90
VSC-G170	1240	660	400	1200	570	169
VSC-G205	1240	660	400	1200	570	176
VSC-G240	1240	660	400	1200	570	209
VSC-G280	1240	660	400	1200	570	211
VSC-G327	1240	660	400	1200	570	214
VSC-H60	970	550	380	930	400	72
VSC-H73	970	550	380	930	400	72
VSC-H86	970	550	380	930	400	78
VSC-H102	970	550	380	930	400	82
VSC-H140	1240	660	400	1200	570	167
VSC-H170	1240	660	400	1200	570	193
VSC-H205	1240	660	400	1200	570	200
VSC-H240	1240	660	400	1200	570	209

READ THIS FIRST

1. The chassis must be mounted in a Clean, Dry, Vibration Free location.
2. Protect the chassis against dust, corrosive gases and liquid sprays.
3. Operating Temperature: 0°C to 50°C.
4. Mount the chassis vertically, away from heat radiating sources.
5. If the chassis is mounted inside an enclosure, heat dissipation must be allowed for. Plastic enclosures are NOT recommended due to their poor heat dissipation.
6. Do not allow hot air from one VSC to enter any other VSC.
7. Allow a 200mm space either side and in front of the chassis for ventilation.

VSC Enclosure Mechanical Installation and Physical Dimensions - Supplementary



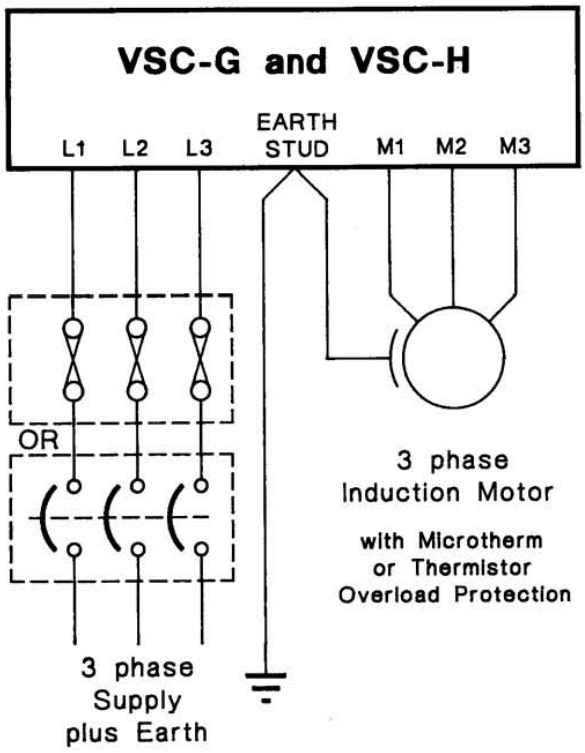
1. All dimensions are in mm.
2. Mounting holes are 12mm diameter.
3. Dimension tolerance: ±1mm.
4. DO NOT allow swarf or any other conductive material to enter the chassis or damage may result.

Model Number	H mm	W mm	D mm	A mm	B mm	Weight kg
VSC-G73	970	550	380	930	400	79
VSC-G86	970	550	380	930	400	80
VSC-G102	970	550	380	930	400	84
VSC-G140	970	550	380	930	400	97
VSC-G170	1240	660	400	1200	570	174
VSC-G205	1240	660	400	1200	570	181
VSC-G240	1240	660	400	1200	570	214
VSC-G280	1240	660	400	1200	570	216
VSC-G327	1240	660	400	1200	570	219
VSC-H60	970	550	380	930	400	79
VSC-H73	970	550	380	930	400	79
VSC-H86	970	550	380	930	400	85
VSC-H102	970	550	380	930	400	89
VSC-H140	1240	660	400	1200	570	172
VSC-H170	1240	660	400	1200	570	198
VSC-H205	1240	660	400	1200	570	205
VSC-H240	1240	660	400	1200	570	214

READ THIS FIRST

1. The VSC enclosure must be mounted in a vibration free location.
2. Protect the enclosure againt dust build-up and dripping or sprayed liquids.
3. Operating Temperature: 0°C to 50°C.
4. Mount the enclosure vertically, away from heat radiating sources.
5. Allow 200mm either side and in front of the enclosure for ventilation.
6. Do not mount the enclosure in direct sunlight or on hot surfaces.
7. If the enclosure is mounted inside another enclosure, the total heat dissipation must be allowed for.

VSC Power Wiring Diagram - Supplementary

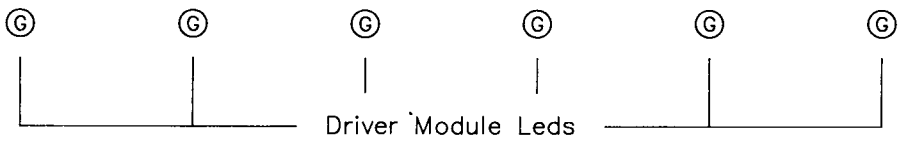


READ THIS FIRST

1. Power Input and Output terminals are located at the bottom of the chassis.
2. EITHER Fuses OR a Circuit Breaker should be connected as shown opposite.
3. Locate the VSC Name Plate and check the Input Voltage BEFORE connecting mains power.
4. Microtherms or Thermistors should be installed in the motor for overload protection. Refer to the VSC control wiring diagram for trip contact connection details.
5. Input Voltage tolerance is -15% to +10% of nameplate value.
6. Do not connect contactor or relay coils to the VSC output terminals.
7. Cable sizes should be selected according to local codes or standards. The Input Current table may be used for cable selection.

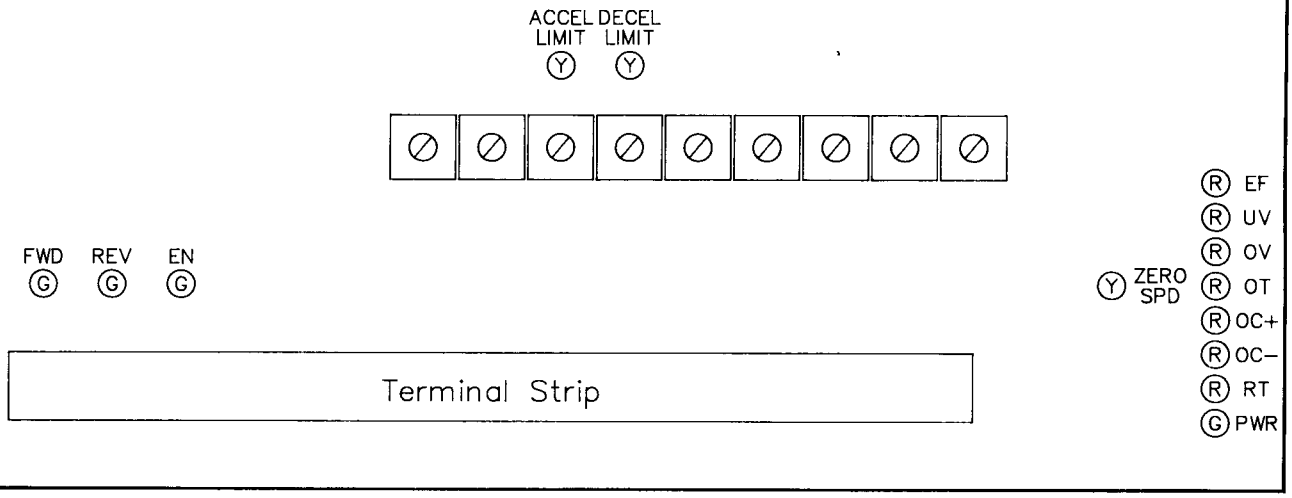
Recommended Fuse and Circuit Breaker Ratings				VSC Output Current	
Model Number	Input Current		Fuse or C/B Rating	Continuous	Intermittent
	Continuous	Intermittent			
VSC-G73	81 A	90 A	100 A	73 A	81 A
VSC-G86	95 A	105 A	150 A	86 A	95 A
VSC-G102	112 A	124 A	150 A	102 A	112 A
VSC-G140	154 A	170 A	200 A	140 A	154 A
VSC-G170	187 A	208 A	250 A	170 A	187 A
VSC-G205	226 A	246 A	250 A	205 A	223 A
VSC-G240	264 A	292 A	300 A	240 A	264 A
VSC-G280	308 A	340 A	350 A	280 A	308 A
VSC-G327	360 A	396 A	400 A	327 A	360 A
VSC-H60	66 A	100 A	100 A	60 A	90 A
VSC-H73	81 A	122 A	150 A	73 A	110 A
VSC-H86	95 A	143 A	150 A	86 A	129 A
VSC-H102	112 A	168 A	200 A	102 A	153 A
VSC-H140	154 A	232 A	250 A	140 A	210 A
VSC-H170	187 A	282 A	300 A	170 A	255 A
VSC-H205	226 A	340 A	350 A	205 A	308 A
VSC-H240	264 A	396 A	400 A	240 A	360 A

VSC Led Indicator Locations



Driver Module Leds illuminate to indicate normal operation of the Driver Modules.
They are only on when the VSC is Enabled, a Direction selected and the Speed Reference is greater than zero.

VSC Control Board



FWD	Forward Direction Selected
REV	Reverse Direction Selected
EN	VSC Enabled
ACCEL LIMIT	Acceleration Limit Operating
DECEL LIMIT	Deceleration Limit Operating
ZERO SPD	VSC at Zero Speed

Key: (G) Green Led; (Y) Yellow Led; (R) Red Led

EF	Earth Fault	Earth Fault in motor or motor wiring
UV	Under Voltage	Input Voltage less than 85% of Nameplate Voltage
OV	Over Voltage	Input Voltage or DC Buss Voltage excessive
OT	Over Temperature	Heatsink Temperature excessive
OC+	Over Current Plus	Output Current has exceeded maximum allowable
OC–	Over Current Minus	Regeneration Current has exceeded max. allowable
RT	Remote Trip	Remote Trip contact is open
PWR	Power On	

VSC START-UP PROCEDURE

Your VSC will operate correctly if the motor has been connected as shown in the Power Wiring diagrams and appropriate connections have been made as shown in the Control Wiring diagrams.

This procedure is intended as a guide and should provide a successful start-up for most applications. However, if more information is required, we suggest you refer to the VSC Applications Manual.

Before connecting Power to your VSC, ensure that the input supply voltage corresponds to the nameplate specifications of your controller.

CUSTOMER ADJUSTMENTS

Set the Application Selection Switches to suit your installation. Refer to the VSC Adjustments diagram.

Set the Customer Adjustments as shown on the VSC Adjustment diagram.

START BOOST RANGE SELECTION

There are four Start Boost ranges: Low, Normal, Medium and High. These ranges provide different Volts/Hertz profiles at low speeds so that the motor starting torque can be selected to suit specific applications.

The Normal Start Boost range is sufficient for most applications. If you require high starting torque or increased energy savings from an over sized motor, use the guide below for selection details.

Low Start Boost:	Fans and centrifugal pumps. Square law torque — speed relationship. Low break-away torque required. Achieves the highest energy saving for lightly loaded or over sized motors.
Normal Start Boost:	General purpose applications. Conveyers.
Medium Start Boost:	High starting torque required. Mono Pumps, Crushers, Vibratory feeders, etc. High break-away torque required.
High Start Boost:	Maximum torque required over the entire speed range.

WARNING

If you have selected the Medium or High Start Boost Ranges, or if the Start Boost adjustment is set above 70%, continuous operation at low speeds may result in excessive motor heating. If continuous operation at low speed is required the motor should be over sized and/or externally cooled. Refer to the VSC Applications Manual for more information regarding Start Boost.

START-UP

Set the speed control signal or speed potentiometer for zero speed. Set the Start/Stop circuitry to the Stop position.

SWITCH ON INPUT POWER

The "PWR" and "ZSP" leds should illuminate. If not, refer to the trouble shooting guide on page 14.

With the speed signal at zero, activate the start circuit. The "EN" and "FWD" or "REV" leds should illuminate. If they do not, or if any fault leds illuminate, refer to the trouble shooting guide on page 14.

Slowly increase the speed control signal. The "ZSP" led should go out and the six green driver module leds should illuminate. The motor should begin to rotate.

If the "ZSP" led does not go out or the motor does not rotate refer to the trouble shooting guide on page 14.

If the motor rotates in the wrong direction, activate the stop circuit, REMOVE INPUT POWER and swap any two motor phase wires. Re-apply input power and activate the start circuit.

Increase the speed control signal to maximum. The motor should accelerate smoothly to full speed. This should take approx 8 seconds if you have selected the short accel/decel range, or approx 60 seconds for the long accel/decel range.

START BOOST ADJUSTMENT

If the motor is reluctant to rotate, slowly increase the Start Boost adjustment until it rotates normally. Do not increase this adjustment any further than necessary to obtain proper operation or excessive motor heating may result.

Increasing the Start Boost adjustment too far may result in the "ACCEL LIMIT" led illuminating AND the motor failing to accelerate. This indicates that the motor is drawing too much current and the Start Boost should be reduced and/or the Accel Time increased.

If your load requires high starting torque, careful setting of the Start Boost adjustment may be insufficient to provide normal motor operation. This may require re-selection of the Start Boost Range described on page 10. If you are having difficulty obtaining correct motor operation, refer to the Applications Manual for further details of Start Boost adjustment.

VOLTS/HERTZ ADJUSTMENT

The V/Hz adjustment need not be varied for most applications. If you do wish to adjust it, attach a clamp-on ammeter (tong tester) to one of the motor phases. Run the motor at 40 Hz(about 4V between terminals 14 and 12) and maximum load. Adjust the V/Hz for minimum motor current.

ACCEL TIME ADJUSTMENT

The Accel Time may be adjusted to suit your application. If it is set for fast acceleration the motor may draw excessive current, activating the Accel Limit circuit. If this happens, the Accel Limit led will illuminate and the VSC will limit the acceleration rate to avoid exceeding the current limit point of the controller. Faster acceleration can not be achieved at this load level.

DECEL TIME ADJUSTMENT

The Decel Time may be adjusted to suit your application. If it is adjusted for fast deceleration the motor may regenerate excessively, activating the Decel Limit circuit. If this happens, the Decel Limit led will illuminate and the VSC will limit the deceleration rate to avoid excessive regeneration. If the deceleration time is excessive, a VSC Braking Module may be required.

MAX SPEED ADJUSTMENT

The maximum speed may be set by adjusting the Max Speed adjustment. It may be set anywhere in the range 50% (fully counter-clockwise) to 100% (fully clockwise) of the selected output frequency.

MIN SPEED ADJUSTMENT

The minimum motor speed may be set by adjusting the Min Speed adjustment. It may be set anywhere in the range 0% (fully counter-clockwise) to 50% (fully clockwise) of the speed set by the Max Speed adjustment. Note that even if the speed control signal is set to zero speed, the motor will accelerate to and run at the speed set by the Min Speed adjustment as soon as the start circuit is activated.

CURRENT LIMIT ADJUSTMENT

Normally, the Current Limit adjustment is set to 100% (fully clockwise). This corresponds to 150% of rated current for High Performance and Single Phase VSC's and 110% of rated current for General Purpose VSC's. You may reduce the current limit point of your VSC to suit your application.The current limit adjustment allows you to set the maximum current anywhere in the range:

75% rated current to 150% rated current for High Performance and Single Phase VSC's.

55% rated current to 110% rated current for General Purpose VSC's.

SLIP COMPENSATION ADJUSTMENT

The Slip Compensation feature provides more accurate speed holding for the induction motor by sensing motor load and automatically varying the output frequency and voltage to compensate for the resulting change in motor slip.

If accurate speed holding is of little importance in your application, there is no need to adjust Slip Compensation. Leave it set fully counter-clockwise.

The following procedure describes how to adjust Slip Compensation for optimum speed regulation. In order to complete the procedure, you will need to measure the motor shaft speed, or the speed of a relevant part of the machine it is driving. This is usually done with a Hand Tachometer.

Run the motor at the normal operating speed for your application. If you are unsure run the motor at about 40 Hz (about 4 Vdc between terminals 14 and 12).

Start with the motor unloaded (or the lowest likely load). Measure the motor speed (or machine speed) and record the result. Then run the motor fully loaded (or the highest likely load). Measure the motor or machine speed, it should be lower than the unloaded speed. Increase the Slip Compensation adjustment until the loaded and unloaded speeds are the same.

Repeat this process until the lightly loaded speed is the same as the heavily loaded speed.

FLUX COMPENSATION ADJUSTMENT

Flux Compensation provides energy savings by automatically reducing the motor "magnetization" or flux whenever the motor is not fully loaded. It is most effective when the motor has been "Over Sized" for the load it is required to drive. Motor heating is also reduced.

Maximum benefit can be obtained when the Low or Normal Start Boost ranges are selected. Flux Compensation has little or no effect when the High Start Boost range is selected or if the motor is always required to deliver full load.

Run the motor at the normal operating speed for your application. If you are unsure run the motor at about 40 Hz (about 4 Vdc between terminals 14 and 12).

Use a clamp-on ammeter (tong tester) to measure the motor phase current.

Increase the Flux Compensation adjustment. This should reduce the motor current. If not, your motor is fully loaded and no benefit can be obtained. If the current does decrease, advance the Flux Compensation adjustment until the current is at a minimum.

If the motor becomes unstable or the current begins to fluctuate, reduce the Flux Compensation adjustment until the motor operates normally.

This completes the start up and adjustment of your VSC.

VSC Start-up Trouble Shooting Guide

Symptom	Cause	Remedy
PWR Led does not illuminate.	Input Power Wiring not connected properly. Input Voltage not within specification.	Check Input Power Wiring Refer to the VSC Power Wiring diagram. Measure Input Voltage at Input Terminals Check against Specification Label.
EN and FWD or REV Leds do not illuminate when the start Circuit is activated. No other Fault Leds illuminate.	Control Wiring not connected properly. External fault in control wiring.	Check all wiring to terminals 1,2,3 and 4. Refer to the VSC Control Wiring Diagram. Check operator control devices.
Controller will not start and the RT Led illuminates.	Remote Trip contact is not closed.	Check the wiring to the Remote Trip contact, it should be closed. If no RT contact is used, bridge terminals 4 and 5.
ZSP Led remains on when the speed reference is increased.	Speed Control signal not properly connected. Incorrect Speed Input selected.	Check wiring on terminals 7,8,9,10,11 & 12. Refer to the VSC Control Wiring Diagram. If only Speed Reference No 1 is required, terminals 5 and 6 should be bridged. If only Speed Reference No 2 is to be used terminals 5 and 6 should be open. If a Speed Reference Selector Switch is installed, be sure it is properly selected.
Motor does not rotate when the VSC is started and the speed signal is increased.	Insufficient Start Boost. Incorrect V/Hz Range selection. Incorrect output frequency selection. Incorrect Start Boost Range selection. Motor incorrectly wired. Incorrect motor voltage.	Increase Start Boost Adjustment. Check V/Hz Range against VSC Adjustment diagram. Check Output Frequency Range against VSC Adjustment Diagram. Check Start Boost Range against VSC Adjustment Diagram. Check motor wiring. Check motor voltage.
The Accel Limit Led Illuminates continuously when the speed signal is advanced. The motor will not accelerate.	Start Boost too high. Current Limit set too low. Accel Time set too short. Incorrect V/Hz range. Incorrect Start Boost range. Motor Rating is much higher than VSC rating. Motor shaft jammed. Motor mechanically overloaded. Motor incorrectly wired. Incorrect motor voltage.	Reduce Start Boost Adjustment. Increase Current Limit adjustment. Increase Accel Time adjustment. Check V/Hz Range selection. Check Start Boost Range selection. Use a VSC with a rating within 75% of the motor rating. Check mechanical drive system. Check actual mechanical load is within the motor's capacity at the required speed. Check motor wiring. Check motor voltage.
Decel Limit Led remains on during deceleration. The motor will not decelerate.	Motor is continuously over-hauling. Motor rating is much higher than VSC rating.	Fit a Braking Module. Use a VSC with a rating within 75% of the motor rating.
Motor does not run at the desired speed.	Incorrect Frequency Range selection. Min Speed adjustment. Max Speed adjustment. Speed Reference.	Check selection of Frequency Range. Check Min Speed adjustment. Check Max Speed adjustment. Check Speed Reference is correct.

VSC Start-up Trouble Shooting Guide

Symptom	Cause	Remedy
OV Led illuminates.	Input Voltage is not within specification. Decel Time too short.	Check Input Voltage at input terminals, measure all phases. Increase the Decel time.
UV Led illuminates.	Input Voltage is not within specification.	Check Input Voltage at input terminals. Make sure all phases are present.
OC+ Led illuminates.	Start Boost too high. Incorrect Start Boost Range selected. Incorrect V/Hz Range selected. Accel Time too short. Short circuit in motor or motor wiring. Open Circuit in motor wiring.	Reduce Start Boost Adjustment. Check Start Boost Range selection. Check V/Hz range selection. Increase Accel time. Check motor and motor wiring for faults. Check motor wiring for faults.
OC– Led illuminates.	Braking Module incorrectly fitted. Short circuit in motor or motor wiring. Open circuit in motor wiring.	Check installation of Braking Module. Check motor and motor wiring for faults. Check motor wiring for faults.
OT Led illuminates.	Ventilation problem. Start Boost is high and motor is running at low speed for long periods. Incorrect V/Hz Range selection. High Ambient Temperature.	Check ventilation. Consult the VSC Applications Manual for details relating to high Start Boost settings. Incorrect use of Start Boost may result in motor overheating. Check V/Hz Range selection. Ambient temperature must be below 50°C for the VSC to operate.
EF Led illuminates.	Earth Fault in motor or motor wiring.	Check motor and motor wiring for faults.
Motor is unstable.	Incorrect V/Hz range selection. Flux Comp too high. Slip Comp too high. Accel time too short. Decel time too short.	Check V/Hz range selection. Reduce Flux Comp adjustment. Reduce Slip Comp adjustment. Increase Accel time adjustment. Increase Decel time adjustment.
Excessive motor heating.	Start Boost is high and motor is running at low speed for long periods. Incorrect V/Hz Range selection. Motor speed is too high. Motor is overloaded. Motor incorrectly wired. Incorrect motor voltage.	Do Not run the motor at low speeds for long periods with high Start Boosts unless the motor has been suitably derated. Refer to the Applications Manual for details. Check the V/Hz Range selection. Check the frequency range selection. Check that the motor is not overloaded. Check motor wiring. Check motor voltage.