

# VARISPEED-656DC5

# INSTRUCTION MANUAL

SINE-WAVE PWM CONVERTER WITH POWER REGENERATION

MODEL: CIMR-D5A [ ] [ ] [ ] [ ] [ ] [ ]

200 to 230 V, 27 to 120 HP (20 to 90 kW)

380 to 460 V, 27 to 249 HP (20 to 185 kW)

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Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

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## PREFACE

YASKAWA's VARISPEED-656DC5 is a sine-wave PWM converter with power regeneration. This instruction manual describes installation, maintenance and inspection, troubleshooting, and specifications of the VS-656DC5. Read this instruction manual thoroughly before operation.

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### General Precautions

- Some drawings in this manual are shown with the protective cover or shields removed, in order to describe detail with more clarity. Make sure all covers and shields are replaced before operating this product.
- This manual may be modified when necessary because of improvement of the product, modification, or changes in specifications.  
Such modifications are denoted by a revised manual No.
- To order a copy of this manual, if your copy has been damaged or lost, contact your YASKAWA representative.
- YASKAWA is not responsible for any modification of the product made by the user, since that will void your guarantee.

## SAFETY INFORMATION

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of the VS-656DC5. In this manual, NOTES FOR SAFE OPERATION are classified as "WARNING" or "CAUTION."




Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury to personnel and damage to equipment.

It may also be used to alert against unsafe practices.

Even items described in  may result in a vital accident in some situations.

In either case, follow these important notes.



These are steps to be taken to insure proper operation.

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## NOTES FOR SAFE OPERATION

### ■ RECEIVING

#### CAUTION

(Ref. Page)

- Do not install or operate any VS-656DC5 which is damaged or has missing parts.  
Failure to observe this caution may result in personal injury or equipment damage.

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### ■ INSTALLATION

#### CAUTION

(Ref. Page)



- Lift the cabinet by the base. When moving the VS-656DC5, never lift by the front cover or the front panel.  
Otherwise, the main unit may be dropped causing personal injury or damage to the VS-656DC5.
- Mount the VS-656DC5 on nonflammable material (i.e. metal).  
Failure to observe this caution may result in a fire.
- When mounting several Units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 45 °C.  
Overheating may cause a fire or damage to the VS-656DC5.


E-5

E-5

E-5

■ WIRING

 <b>WARNING</b>	
	(Ref. Page)
<ul style="list-style-type: none"> <li>• Only commence wiring after verifying that the power supply is turned off. Failure to observe this warning may result in an electric shock or a fire.</li> </ul>	E-11
<ul style="list-style-type: none"> <li>• Wiring should be performed only by qualified personnel. Failure to observe this warning may result in an electric shock or a fire.</li> </ul>	E-11
<ul style="list-style-type: none"> <li>• Make sure to ground the ground terminal  before connecting the other terminals. (200 V class: Ground to 100 Ω or less, 400 V class: Ground to 10 Ω or less). Failure to observe this warning may result in an electric shock or a fire.</li> </ul>	E-11

 <b>CAUTION</b>	
	(Ref. Page)
<ul style="list-style-type: none"> <li>• Verify that the VS-656DC5 rated voltage coincides with the AC power supply voltage. Failure to observe this caution may result in personal injury or a fire.</li> </ul>	E-11
<ul style="list-style-type: none"> <li>• Use a power supply with a capacity larger than the value calculated by the formula of power supply capacity selection described on <i>Appendix B</i>. Failure to observe this caution may result in damage to the unit.</li> </ul>	E-11
<ul style="list-style-type: none"> <li>• Do not perform a withstand voltage test of the VS-656DC5. Failure to observe this caution may result in damage to the semi-conductor elements.</li> </ul>	E-11
<ul style="list-style-type: none"> <li>• Connect the input AC reactor, harmonics filter reactor, and the harmonics filter capacitor as described in this instruction manual. Failure to observe this caution may result in a fire.</li> </ul>	E-11
<ul style="list-style-type: none"> <li>• Verify that the rated voltage of the VS-656DC5 coincides with the rated voltage of the Inverter to be connected. Failure to observe this caution may result in a fire.</li> </ul>	E-11
<ul style="list-style-type: none"> <li>• Tighten terminal screws. Failure to observe this caution may result in a fire.</li> </ul>	E-11

## ■ OPERATION

### WARNING

	(Ref. Page)
<ul style="list-style-type: none"><li>• Only turn on the input power supply after attaching the front cover or the terminal cover. Do not remove the cover while current is flowing. Failure to observe this warning may result in an electric shock.</li></ul>	E-30
<ul style="list-style-type: none"><li>• Never operate the Digital Operator or other switches when your hand is wet. Failure to observe this warning may result in an electric shock.</li></ul>	E-30
<ul style="list-style-type: none"><li>• Never touch the terminals while current is flowing, even if the VS-656DC5 stops. Failure to observe this warning may result in an electric shock.</li></ul>	E-30

### CAUTION

	(Ref. Page)
<ul style="list-style-type: none"><li>• Never touch the radiation fins (heatsink) or input reactor since the temperature is very high. Failure to observe this caution may result in harmful burns to the body.</li></ul>	E-30
<ul style="list-style-type: none"><li>• The VS-656DC5 is factory set to the suitable settings. Do not change the settings unnecessarily. Failure to observe this caution may result in damage to the unit.</li></ul>	E-30

## ■ MAINTENANCE AND INSPECTION

### WARNING

	(Ref. Page)
<ul style="list-style-type: none"><li>• Never touch high-voltage terminals in the VS-656DC5. Failure to observe this warning may result in an electric shock.</li></ul>	E-39
<ul style="list-style-type: none"><li>• Perform maintenance or inspection only after verifying that the CHARGE LED goes off, after the main circuit power supply is turned off. The capacitors are still charged and can be dangerous.</li></ul>	E-39
<ul style="list-style-type: none"><li>• Only authorized personnel should be permitted to perform maintenance, inspections, or parts replacement. [Remove all metal objects (watches, bracelets, etc.) before operation.] (Use tools which are insulated against electric shock.) Failure to observe this warning may result in an electric shock.</li></ul>	E-39

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## CAUTION

(Ref. Page)

- A CMOS IC is used in the control board. Handle the control board and CMOS IC carefully. The CMOS IC can be destroyed by static electricity if touched directly.

E-39

The CMOS IC may be destroyed by static electricity if touched directly.

- Do not change the wiring, or connect/disconnect the connectors while power is applied to the circuit.

E-39

Failure to observe this caution may result in personal injury.

### ■ OTHERS

## WARNING

(Ref. Page)

- Never modify the product.

E-39

Failure to observe this warning may result in an electric shock or personal injury.

## CAUTION

(Ref. Page)

- Install adequate branch circuit short circuit protection per applicable codes.

E-39

Failure to comply could result in damage to the VS-656DC5.

The VS-656DC5 is suitable for circuits capable of delivering not more than 100,000 RMS symmetrical Amperes, 230 VAC maximum (200 V Class) and 460 VAC maximum (400 V Class).

- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.

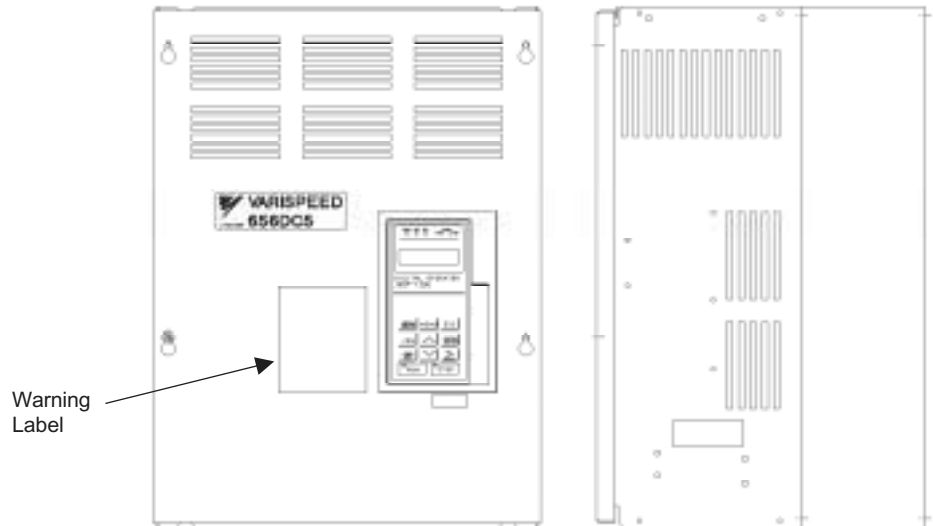
E-39

Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.







If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

## ■ Warning Label Position

A warning label is displayed on the front cover of the VS-656DC5, as shown below. Follow these instructions when handling the VS-656DC5.



## Warning Label

	<b>WARNING</b> – Risk of electric shock.
	<ul style="list-style-type: none"> <li>▪ Read manual before installing.</li> <li>▪ Wait 5 minutes for capacitor discharge after disconnecting power supply.</li> <li>▪ Use proper grounding techniques.</li> </ul>
	<b>AVERTISSEMENT</b> - Risque de décharge électrique.
	<ul style="list-style-type: none"> <li>▪ Lisez le manuel avant installation.</li> <li>▪ Attendez 5 minutes après la coupure de l'alimentation électrique afin que les condensateurs soient complètement déchargés.</li> <li>▪ Soyez à la masse par une bonne technique.</li> </ul>
	<b>危険</b> - けが・感電のおそれがあります。
	<ul style="list-style-type: none"> <li>▪ 据え付け、運転の前には必ず取扱説明書をお読み下さい。</li> <li>▪ 通電中及び電源遮断後5分以内は表面カバーを外さないで下さい。</li> <li>▪ 確実に接地を行ってください。</li> </ul>
NPJT31393-1-0	



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## WARRANTY INFORMATION

### ■ Warranty Period

This product is warranted for twelve months after being delivered to Yaskawa's customer or if applicable eighteen months from the date of shipment from Yaskawa's factory, whichever comes first.

### ■ Scope of Warranty

#### ■ Inspections

Periodic inspections must be conducted by the customer. However, upon request, Yaskawa or one of Yaskawa's Service Centers can inspect the product for a fee. In this case, if after conferring with the customer, a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, then this fee will be waived and the problem remedied free of charge.

#### ■ Repairs

If a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, Yaskawa will provide a replacement, repair the defective product, and provide shipping to and from the site free of charge.

However, if the Yaskawa Authorized Service Center determines that the problem with a Yaskawa product is not due to defects in Yaskawa's workmanship or materials, then the customer will be responsible for the cost of any necessary repairs. Some problems that are outside the scope of this warranty are:

- Problems due to improper maintenance or handling, carelessness, or other reasons where the customer is determined to be responsible.
- Problems due to additions or modifications made to a Yaskawa product without Yaskawa's understanding.
- Problems due to the use of a Yaskawa product under conditions that do not meet the recommended specifications.
- Problems caused by natural disaster or fire.
- Or other problems not due to defects in Yaskawa workmanship or materials.

Warranty service is only applicable within Japan.

However, after-sales service is available for customers outside of Japan for a reasonable fee. Contact your local Yaskawa representative for more information.

### ■ Exceptions

Any inconvenience to the customer or damage to non-Yaskawa products due to Yaskawa's defective products whether within or outside the warranty period are NOT covered by this warranty.

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## RESTRICTIONS

- The VS-656DC5 was not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.
- Customers who intend to use the product described in this manual for devices or systems relating to transportation, health care, space aviation, atomic or electric power, or underwater use must contact their Yaskawa representatives or the nearest Yaskawa sales office beforehand.
- This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where failure of this product could involve or result in a life-and-death situation or loss of human life or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.

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# 1 RECEIVING

## ⚠ CAUTION

- Do not install or operate any VS-656DC5 which is damaged or has missing parts.  
Failure to observe this caution may result in personal injury or equipment damage.

This chapter describes how to verify the VS-656DC5 after delivery to the user.

## 1.1 Checks

Table 1 Checks

Item	Method
Does the VS-656DC5 model number correspond with the purchase order?	Check the model number on the nameplate on the side of the VS-656DC5. (Refer to <i>page E-4</i> .)
Are any parts damaged?	Visually check the exterior and verify that there was no damage during transport.
Are any screws or other components loose?	Use a screwdriver or other tools to check for tightness.

If any of the above items are not satisfactory, contact your YASKAWA representative.

## 1.2 Nameplate Information

### ■ Nameplate Example

The following nameplate is an example for a standard domestic (Japan) VS-656DC5: 3-phase, 400 VAC, 30 kW, IEC IP00.

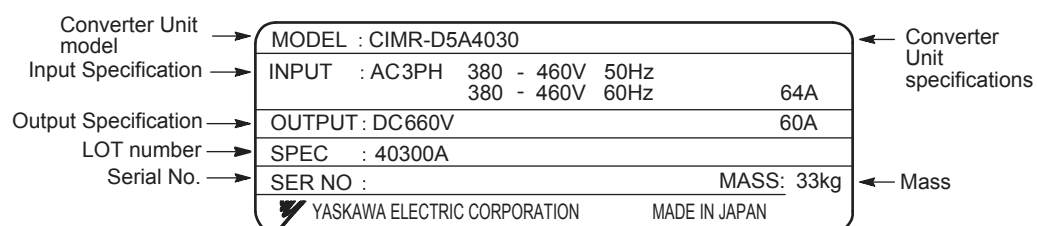
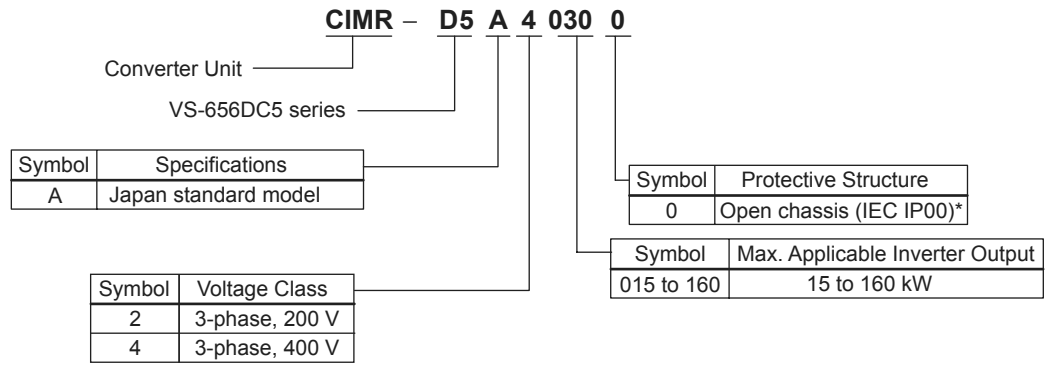


Fig. 1 Nameplate

## ■ VS-656DC5 Model Number and Specifications



\* Protected so that parts of the human body cannot reach electrically charged parts from the front when the VS-656DC5 is mounted in a control panel.

Fig. 2 VS-656DC5 Model Number and Specifications

## 2 INSTALLATION

### CAUTION

- Lift the cabinet by the base. When moving the VS-656DC5, never lift by the front cover or the front panel.  
Otherwise, the main unit may be dropped causing personal injury or damage to the VS-656DC5.
- Mount the VS-656DC5 on nonflammable material (i.e. metal).  
Failure to observe this caution may result in a fire.
- When mounting several Units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 45 °C.  
Overheating may cause a fire or damage to the VS-656DC5.

This chapter describes the configuration, location, and space when mounting the VS-656DC5.

### 2.1 Checking Installation Site

#### ■ Installation Site

Install the VS-656DC5 under the following conditions.

Type	Ambient Operating Temperature	Humidity
Open chassis	-10 to +45 °C	90% RH or less (no condensation)

To ensure proper performance and long operating life, follow the recommendations below when choosing a location for installing the VS-656DC5. Make sure the VS-656DC5 is protected from the following conditions:

- Extreme cold and heat  
Use only within ambient temperature range: -10 °C to +45 °C
- Rain, moisture
- Oil sprays, splashes
- Salt spray
- Direct sunlight (Avoid using outdoors.)
- Corrosive gases or liquids
- Dust or metallic particles in the air
- Physical shock, vibration
- Magnetic noise (Example: welding machines, power devices, etc.)
- High humidity
- Radioactive materials
- Combustibles: thinners, solvents, etc.

## ■ Controlling the Ambient Temperature

To enhance the reliability of operation, the VS-656DC5 should be installed in an environment free from extreme temperature increases. If the VS-656DC5 is installed in an enclosed environment, such as a box, use a cooling fan or air conditioner to maintain the internal air temperature below 45 °C.

## ■ Protecting the VS-656DC5 from Foreign Matter

Place a cover over the VS-656DC5 during installation to shield it from metal powder produced by drilling.

Always remove the cover from the VS-656DC5 after completing installation. Otherwise, ventilation will be reduced, causing the VS-656DC5 to overheat.

## 2.2 Clearances

Install the VS-656DC5 vertically and allow sufficient clearances for effective cooling as shown in *Fig. 3*.

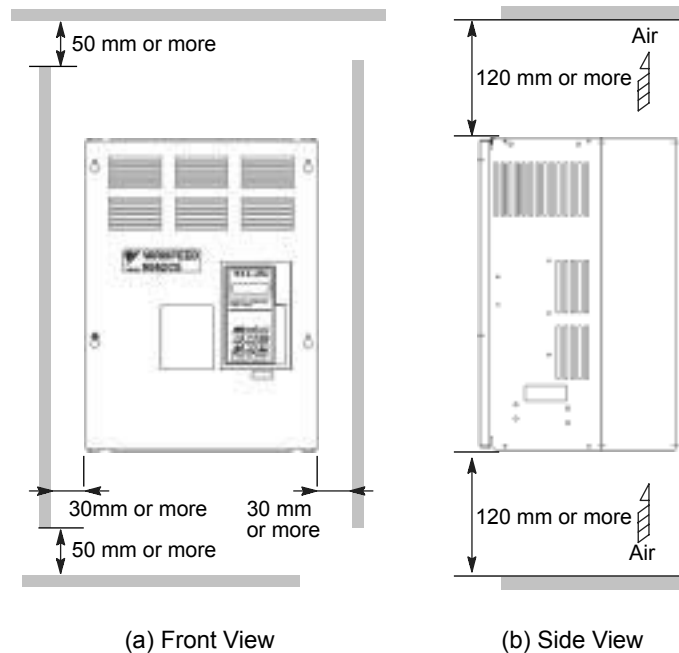


Fig. 3 Clearances



When installing the open chassis type of 200 V/400 V 30 kW or more, extra spacing will be required on either side for eyebolts or main circuit wiring.



## 2.3 Dimensions

### ■ Models of 200 V/400 V 15 kW or Less

The following figure shows a 200 V 15 kW model.

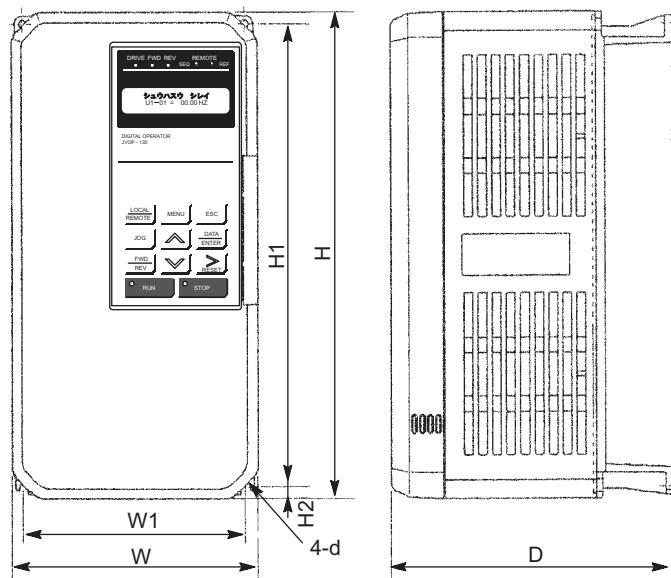


Fig. 4 Dimensions of VS-656DC5

### ■ Models of 200 V/400 V 22 kW or More

The following figure shows a 200 V 22 kW model.

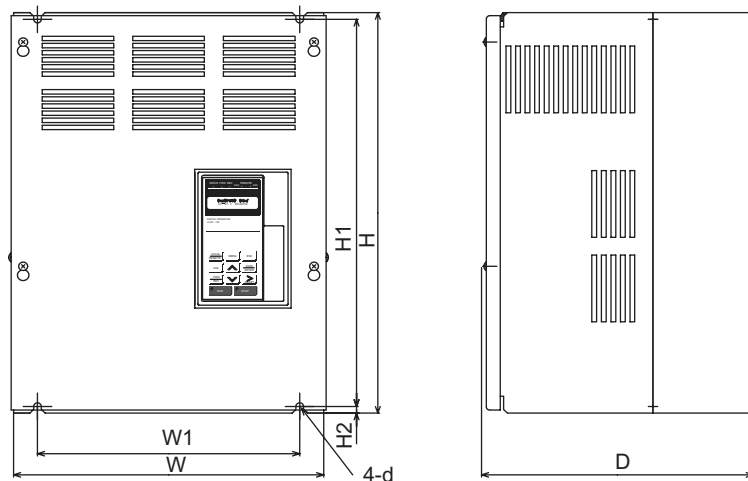


Table 2 VS-656DC5 External Dimensions and Approx. Masses

Unit: mm

Voltage Class	VS-656DC5 Model CIMR-D5A□□□□	Open Chassis (IP00)							Approx. Mass [kg]	Mounting Hole d
		W	H	D	W1	H1	H2			
200 V Class	2015	250	380	225	236	365	7.5	11	M6	
	2022	325	450	285	275	435	7.5	23	M6	
	2037	425	725	350	320	700	12.5	47	M10	
	2075	575	885	380	445	885	15.0	85	M12	
400 V Class	4015	250	380	225	236	365	7.5	10	M6	
	4022	325	450	285	275	435	7.5	26	M6	
	4030	325	625	285	275	610	7.5	33	M6	
	4045							36	M6	
	4075	455	820	350	350	795	12.5	60	M10	
	4160	575	925	400	445	895	15.0	117	M12	

Note: An attachment is required to mount the cooling fins (fin section) on the outside of the control panel for 200 V/400 V class VS-656DC5 of 15 kW or less. Contact your YASKAWA representative for details. For dimensional drawings for models with externally mounted cooling fins or other special requirements, contact your YASKAWA representative.

## 2.4 Removing/Attaching the Digital Operator

Remove and attach the Digital Operator as follows.

### ■ Removing the Digital Operator

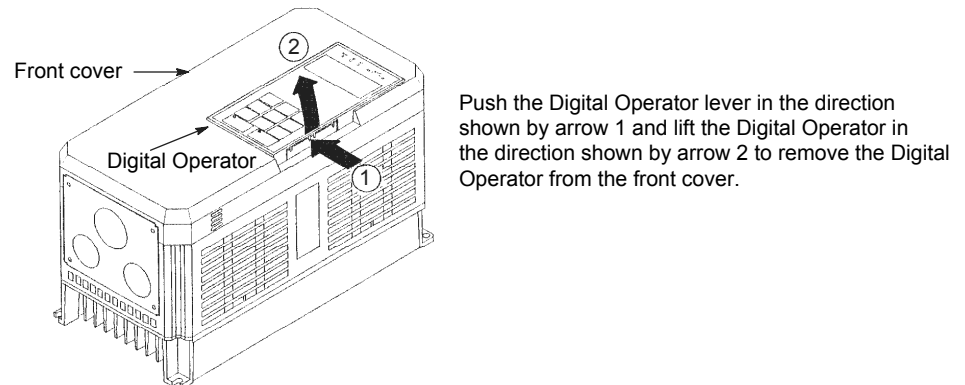


Fig. 5 Removing the Digital Operator

### ■ Attaching the Digital Operator

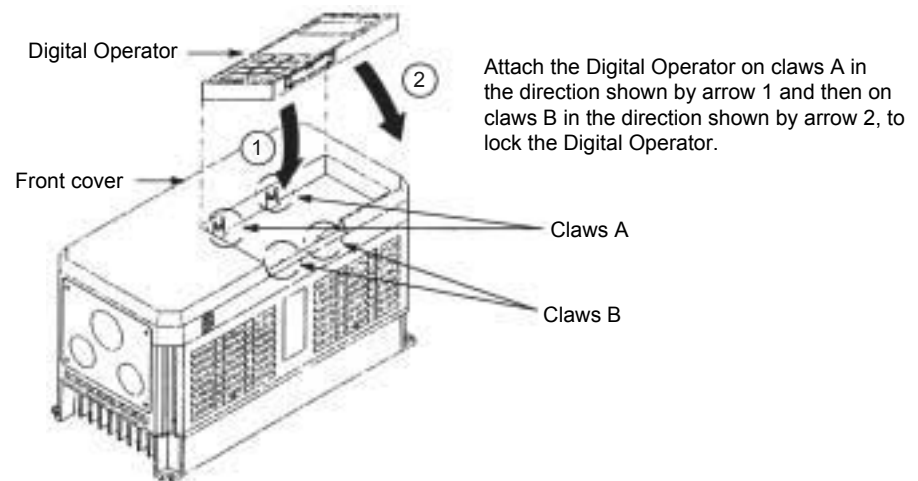


Fig. 6 Attaching the Digital Operator

**NOTE**

Never attach the Digital Operator in any other direction or by any other method, as faulty contact may result.

---

## 2.5 Removing/Attaching the Front Cover

### ■ Models of 15 kW or Less

To remove the front cover, first remove the Digital Operator in the direction shown by arrow 1. (Refer to 2.4 *Removing/Attaching the Digital Operator*.) Then squeeze the cover in the direction shown by arrows 2 on both sides and lift in the direction shown by arrow 3.

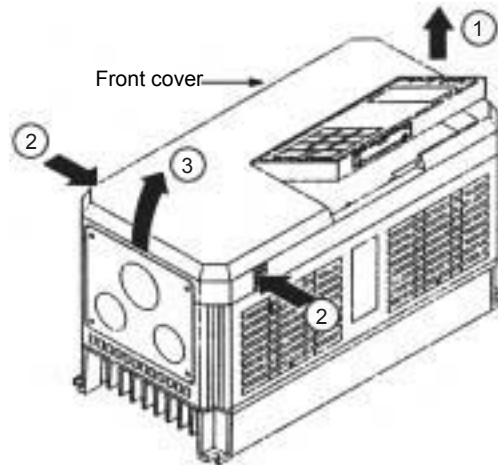


Fig. 7 Removing/Attaching the Front Cover (15 kW or Less)

### ■ Models of 22 kW or More

To remove the front cover, first remove the Digital Operator in the direction shown by arrow 1. (Refer to 2.4 *Removing/Attaching the Digital Operator*.)

Then loosen the four screws shown by arrow 2 and slide the front cover in the direction shown by arrow 3.

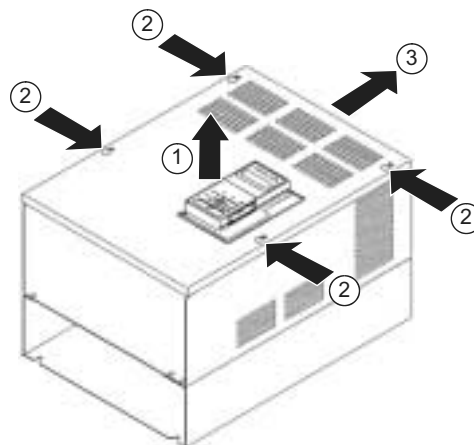


Fig. 8 Removing/Attaching the Front Cover (22 kW or More)




Do not attach the front cover with the Digital Operator connected, as faulty contact may result. Attach the front cover first, and then attach the Digital Operator on the cover. Refer to 2.4 *Removing/Attaching the Digital Operator* for attaching the Digital Operator.

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### 3 WIRING

#### WARNING

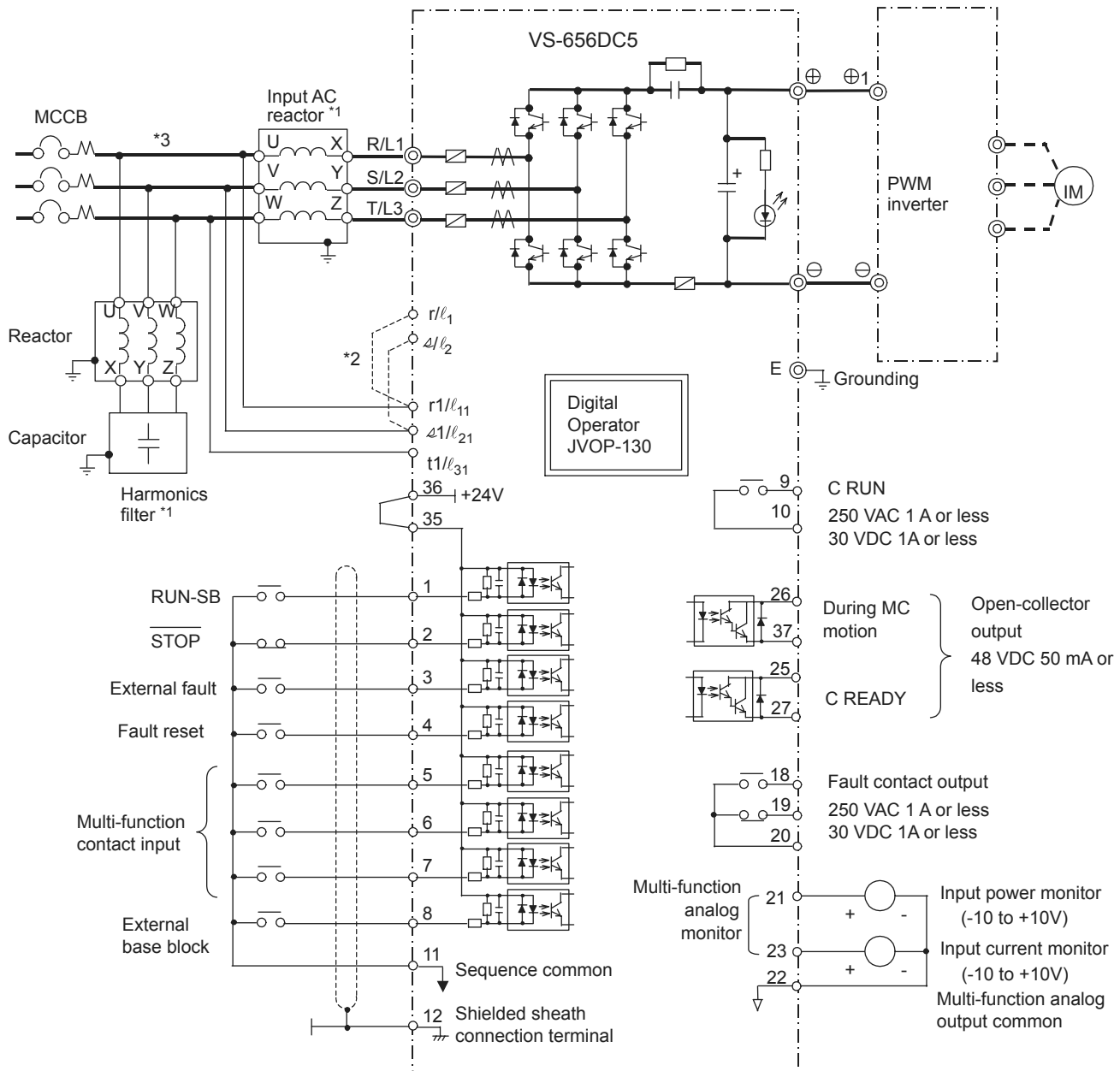
- Only commence wiring after verifying that the power supply is turned off.  
Failure to observe this warning may result in an electric shock or a fire.
- Wiring should be performed only by qualified personnel.  
Failure to observe this warning may result in an electric shock or a fire.
- Make sure to ground the ground terminal  before connecting the other terminals.  
(200 V class: Ground to 100 Ω or less, 400 V class: Ground to 10 Ω or less).  
Failure to observe this warning may result in an electric shock or a fire.

#### CAUTION

- Make sure that the power-supply voltage and the rated voltage show the same values as those specified on the VS-656DC5 nameplate. It is crucial that a 3-phase power supply be used for the unit to run properly.  
Failure to do so can damage the VS-656DC5, result in personal injury, or cause a fire.
- Use a power supply with a capacity larger than the value calculated by the formula of power supply capacity selection described on *Appendix B*.  
Failure to observe this caution may result in damage to the unit.
- Do not perform a withstand voltage test of the VS-656DC5.  
Failure to observe this caution may result in damage to the semi-conductor elements.
- Connect the input AC reactor, harmonics filter reactor, and the harmonics filter capacitor as described in this instruction manual.  
Failure to observe this caution may result in a fire.
- Verify that the rated voltage of the VS-656DC5 coincides with the rated voltage of the Inverter to be connected.  
Failure to observe this caution may result in a fire.
- Tighten terminal screws.  
Failure to observe this caution may result in a fire.

### 3.1 Connection and Specifications of Peripheral Devices

#### ■ Connection



- \* 1. Be sure to attach the input AC reactor (reactor) and harmonics filter (capacitor).
- \* 2. For models CIMR-D5A2022 to -D5A2075 of the 200 V Class and CIMR- D5A4022 to -D5A4160 of the 400 V Class, the wiring was done prior to shipment. Connections are not needed for CIMR-D5A2015 and -D5A4015.

The terminals  $r/l_1$  and  $\Delta/l_2$  in the above diagram are the terminal names for 200 V Class VS-656DC5 with 37 to 75 kW. The terminal names are as follows respectively for each VS-656DC5 capacity:

- 200 V Class 22 kW, 400 V Class 22 to 45 kW:  $\Delta/l_2$ ,  $t/l_3$   
( $\Delta/l_2$  and  $\Delta_1/l_{21}$ ,  $t/l_3$  and  $t_1/l_{31}$  are connected respectively.)

- 400 V Class 75 and 160 kW:  $r/l_1$ ,  $\Delta_{400}/l_{2400}$

- \* 3. When a noise filter is attached on the VS-656DC5 power supply side, use a noise filter of the reactor type (without a capacitor) such as fine met zero-phase reactor, and attach it behind the MCCB at the power supply side. Do not use a capacitor-built-in type noise filter since the harmonic components may overheat or damage the capacitor.

### ■ Specifications of Peripheral Devices

VS-656DC5		Input AC Reactor (ACX)		Harmonics Filter (LC Filter)				
Voltage Class	Applicable Model CIMR-D5A□	Rated Current Arms	Inductance mH	Reactor UZBA-B		Capacitor	Recommended Wire Size mm <sup>2</sup> (AWG)	
				Rated Current Arms	Inductance mH	Capacity μF		
200 V Class	2015	64	1.32	30	0.35	100	3.5 to 5.5 (12 to 10)	12 to 10
	2022	96	0.88	50	0.21	150	3.5 to 5.5 (12 to 10)	12 to 10
	2037	160	0.53	80	0.13	200	5.5 to 8 (10 to 8)	10 to 8
	2075	300	0.28	160	0.07	400	8 to 14 (8 to 6)	8 to 6
400 V Class	4015	32	5.28	15	1.42	25	2 to 5.5 (14 to 10)	14 to 10
	4022	48	3.52	20	1.06	40	3.5 to 5.5 (12 to 10)	12 to 10
	4030	64	2.64	30	0.7	50	3.5 to 5.5 (12 to 10)	12 to 10
	4045	96	1.76	50	0.42	75	3.5 to 5.5 (12 to 10)	12 to 10
	4075	165	1.02	80	0.26	100	5.5 to 8 (10 to 8)	10 to 8
	4160	300	0.57	150	0.15	200	8 to 14 (8 to 6)	8 to 6

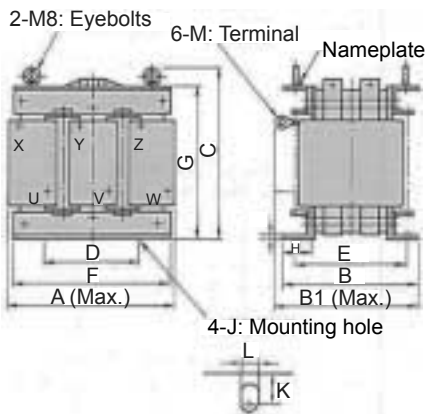
Note: Be sure to use an input reactor and harmonics filter with specifications described in the above list.

### 3.2 External Dimensions of Peripheral Devices

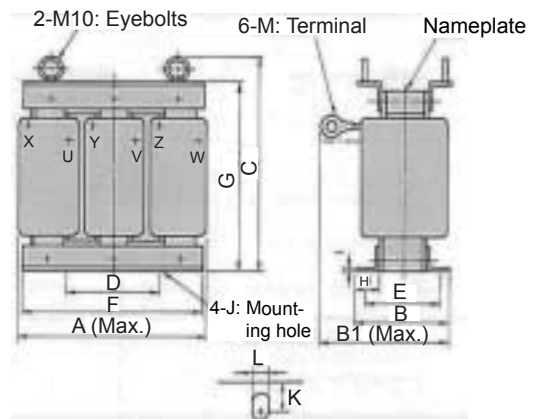
#### ■ Input AC Reactor (Model UZBA-B)

Voltage Class	Applicable Model CIMR-D5A	DWG No.	Dimensions in mm														Approx. Mass kg	Loss W
			A	B	B1	C	D	E	F	G	H	I	J	K	L	M		
200 V Class	2015	1	290	182	266	280±10	150	145	255	240±10	40	5	M10	25	12	M8	50	285
	2022	1	310	222	286	315±10	150	180	270	275±10	50	6	M10	27.5	12	M10	65	395
	2037	2	390	220	320	375±10	150	180	380	330±10	50	6	M12	26	15	M10	95	440
	2075	2	450	240	375	435±10	200	200	430	390±10	50	6	M12	25.5	14	M12	145	680
400 V Class	4015	1	290	182	246	280±10	150	145	255	240±10	40	5	M10	25	12	M6	50	275
	4022	3	330	162	230	330±10	170	130	270	290±10	40	6	M10	20	12	M8	54	335
	4030	1	330	245	322.5	355±10	150	210	300	310±10	50	6	M10	27.5	12	M8	100	525
	4045	2	455	240	330	435±10	200	200	430	390±10	50	6	M12	25.5	14	M10	150	760
	4075	2	450	240	365	435±10	200	200	430	390±10	50	6	M12	25.5	14	M10	155	690
	4160	2	575	330	445	525±10	200	270	530	470±10	75	9	M12	36	15	M12	350	1120

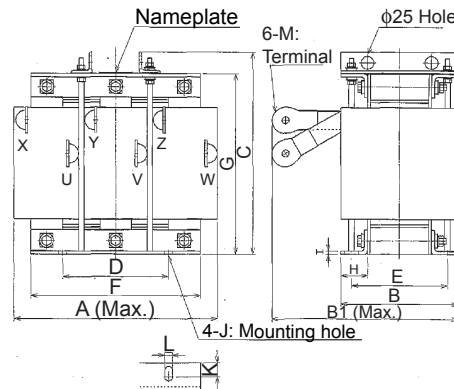
DWG 1



DWG 2



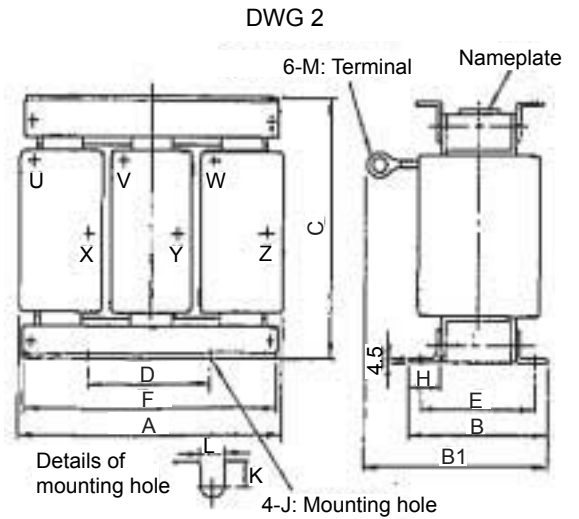
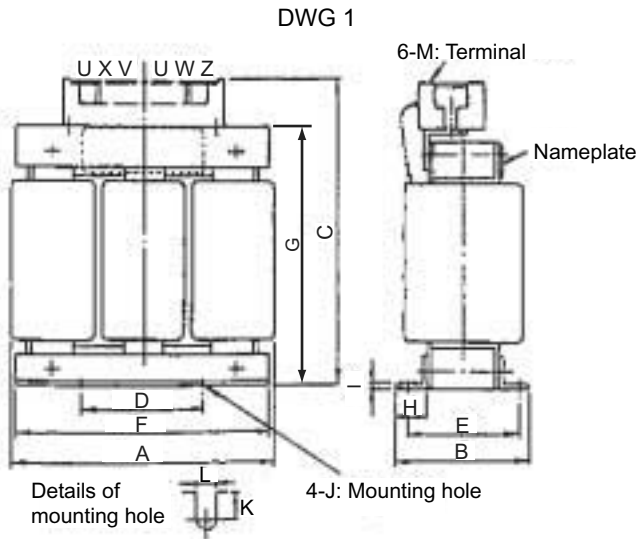
DWG 3





■ Harmonics Filter Reactor

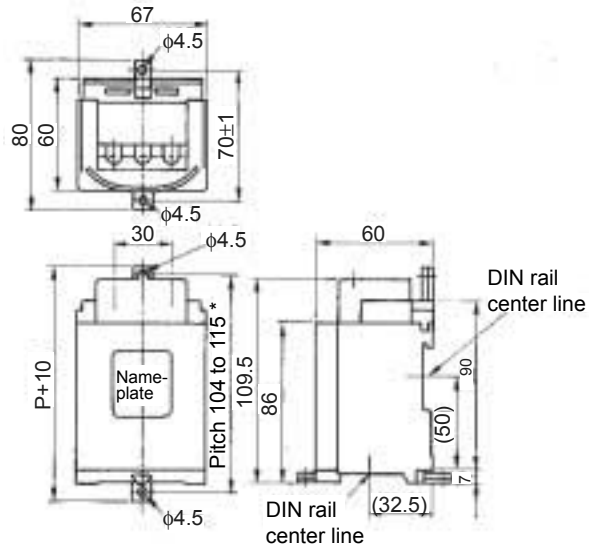
Voltage Class	Applicable Model CIMR-D5A□	DWG No.	Dimensions in mm														Approx. Mass kg	Loss W
			A	B	B1	C	D	E	F	G	H	I	J	K	L	M		
200 V Class	2015	2	130	88	119	105	50	70	130	-	22	3.2	M6	9	7	M5	3	45
	2022	2	160	90	125	130	75	70	160	-	25	2.3	M6	10	7	M6	5	55
	2037	2	180	100	155	150	75	80	180	-	25	2.3	M6	10	7	M8	8	75
	2075	2	210	100	170	175	75	80	205	-	25	3.2	M6	10	7	M10	12	100
400 V Class	4015	1	130	98	-	130	50	80	130	105	22	3.2	M6	9	7	M4	4	50
	4022	2	160	90	115	130	75	70	160	-	25	2.3	M6	10	7	M5	5	50
	4030	2	160	105	132.5	130	75	85	160	-	25	2.3	M6	10	7	M5	6	65
	4045	2	180	100	145	150	75	80	180	-	25	2.3	M6	10	7	M6	8	90
	4075	2	210	100	150	175	75	80	205	-	25	3.2	M6	10	7	M8	12	95
	4160	2	240	126	198	205 <sup>±5</sup>	150	110	240	-	25	3.2	M8	8	10	M10	23	150



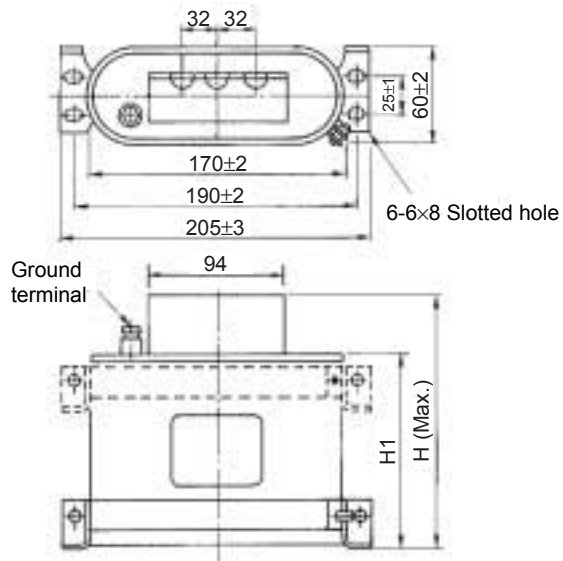
■ Harmonics Filter Capacitor

200 V Class

Applicable Model CIMR-D5A□	Capacity μF	Approx. Mass kg	Loss W
2015	100	0.4	1.8

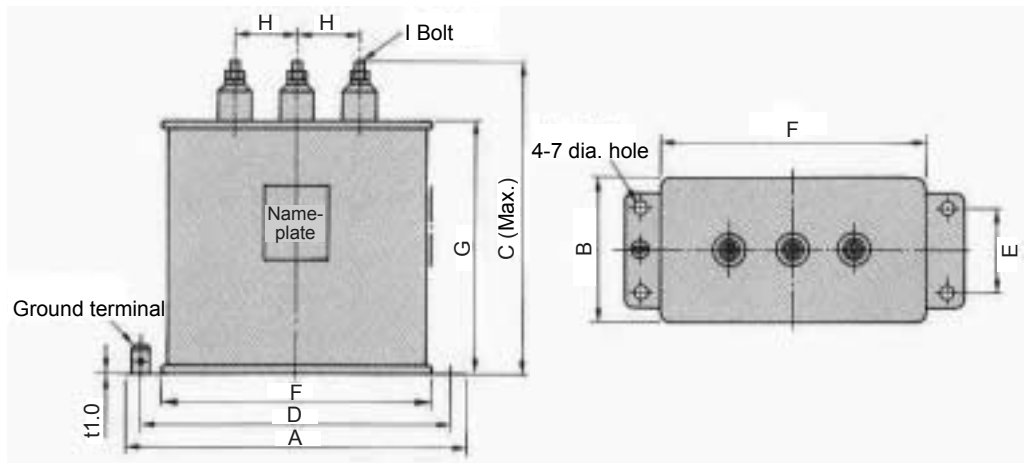


Applicable Model CIMR-D5A□	Capacity μF	Dimensions mm		Approx. Mass kg	Loss W
		H	H1		
2022	150	160	107±3	1.2	2.7
2037	200	160	107±3	1.2	3.6
2075	400	200	147±3	1.6	7.2

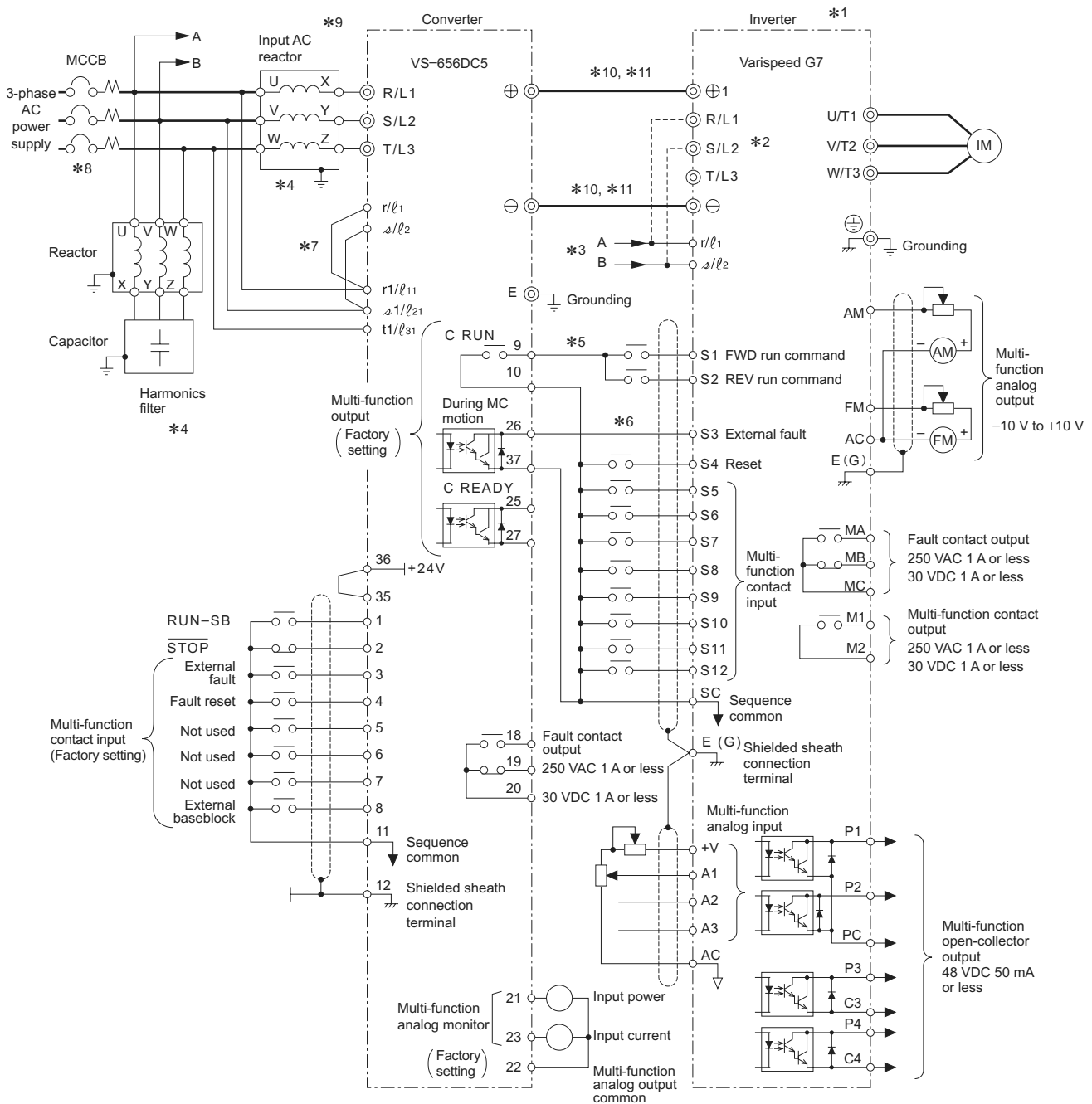


400 V Class

Applicable Model CIMR-D5A□	Capacity μF	Dimensions in mm									Approx. Mass kg	Loss W
		A	B	C	D	E	F	G	H	I		
4015	25	165 <sup>±2</sup>	70 <sup>±2</sup>	135	150 <sup>±1</sup>	40 <sup>±1</sup>	130 <sup>±2</sup>	100 <sup>±3</sup>	30 <sup>±5</sup>	M5	1.3	2.4
4022	40	165 <sup>±2</sup>	70 <sup>±2</sup>	155	150 <sup>±1</sup>	40 <sup>±1</sup>	130 <sup>±2</sup>	120 <sup>±3</sup>	30 <sup>±5</sup>	M5	1.6	3.6
4030	50	165 <sup>±2</sup>	70 <sup>±2</sup>	155	150 <sup>±1</sup>	40 <sup>±1</sup>	130 <sup>±2</sup>	120 <sup>±3</sup>	30 <sup>±5</sup>	M5	1.5	4.8
4045	75			215				180 <sup>±3</sup>			2.3	7.2
4075	100	205 <sup>±2</sup>		185	190 <sup>±1</sup>		173 <sup>±2</sup>	150 <sup>±3</sup>			2.5	9.6
4160	200			305				270 <sup>±3</sup>			4.5	19.2



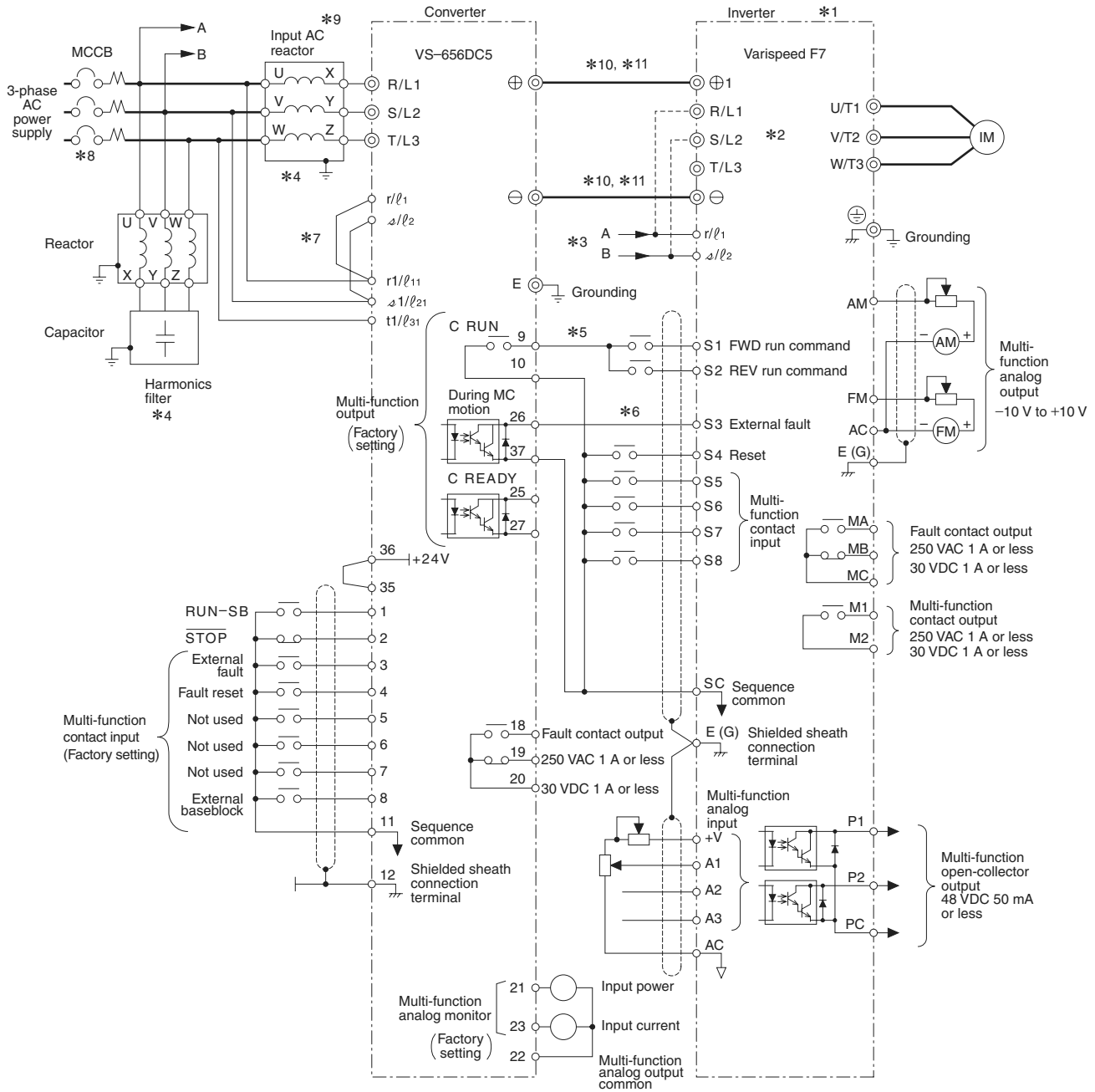
### 3.3 Interconnection Diagram with Varispeed G7



- \* 1. The standard type of Varispeed G7 models for all capacities can be connected to the VS-656DC5.
- \* 2. Do not connect a power supply to the Varispeed G7 AC power supply terminals R/L1, S/L2, and T/L3.
- \* 3. For cooling fan terminals  $r/\ell_1$  and  $\Delta/\ell_2$  of the Varispeed G7 200 V class 30 to 75 kW models, remove the jumper wiring between  $r/\ell_1$  and R/L1, and between  $\Delta/\ell_2$  and S/L2. Then take the power supply for  $r/\ell_1$  and  $\Delta/\ell_2$  from the VS-656DC5 primary power supply line. For cooling fan terminals  $r/\ell_1$  and  $\Delta 400/\ell_2 400$  of the Varispeed G7 400 V class 55 to 160 kW models, remove the jumper wiring between  $r/\ell_1$  and R/L1, and between  $\Delta 400/\ell_2 400$  and S/L2. Then take the power supply for  $r/\ell_1$  and  $\Delta 400/\ell_2 400$  from the VS-656DC5 primary power supply line.
- \* 4. Be sure to use the specified AC reactor and harmonics filter for the VS-656DC5, to avoid abnormal operations.

- \* 5. Set up a sequence whereby the VS-656DC5 starts operation and then the Varispeed G7 starts after the power supply is turned on, and the power supply is turned off after the Varispeed G7, the motor, and the VS-656DC5 are stopped in this order.  
Operating the Varispeed G7 without starting the VS-656DC5, or turning off the power supply while the VS-656DC5 is running may cause the VS-656DC5 to malfunction.
- \* 6. Refer to *Interlocking with Inverters* in *Appendix B PRECAUTIONS ON VS-656DC5 APPLICATION* for details about using an interlock with an Inverter.
- \* 7. For models CIMR-D5A2022 to -D5A2075 of the 200 V class and CIMR- D5A4022 to -D5A4160 of the 400 V class, the wiring was done prior to shipment. Connections are not needed for CIMR-D5A2015 of the 200 V class and CIMR-D5A4015 of the 400 V class.  
The terminals  $r/\ell_1$  and  $\Delta/\ell_2$  in the above diagram are the terminal names for 200 V class VS-656DC5 with 37 to 75 kW. The terminal names are as follows respectively for each VS-656DC5 capacity:
  - 200 V class 22 kW, 400 V class 22 to 45 kW:  $\Delta/\ell_2$ ,  $t/\ell_3$   
( $\Delta/\ell_2$  and  $\Delta_1/\ell_{21}$ ,  $t/\ell_3$  and  $t_1/\ell_{31}$  are connected respectively.)
  - 400 V class 75 and 160 kW:  $r/\ell_1$ ,  $\Delta_{400}/\ell_{2400}$
- \* 8. When a noise filter is attached on the VS-656DC5 power supply side, use a noise filter of the reactor type (without a capacitor) such as fine met zero-phase reactor, and attach it behind the MCCB at the power supply side. Do not use a capacitor-built-in type noise filter since the harmonic components may overheat or damage the capacitor.
- \* 9. The wiring between the input AC reactor and the VS-656DC5 must be within 10 m.
- \* 10. The DC current bus bar wiring between the VS-656DC5 and the Inverter must be within 5 m.
- \* 11. If installing a circuit breaker or a magnetic contactor on the VS-656DC5 output (DC) side to shut down the power supply in an emergency, observe the following precautions.
  - Be sure to confirm that the charge lamps on the VS-656DC5 and the Inverter are not lit, and then turn on the circuit breaker or contactor. If the circuit breaker or contactor is turned on while power is supplied to the VS-656DC5 and the Inverter, an overcurrent may occur and damage the circuit breaker or contactor.
  - Be sure to confirm that the circuit breaker or contactor is turned on before the power is turned on for the VS-656DC5.

### 3.4 Interconnection Diagram with Varispeed F7



- \* 1. The standard type of Varispeed F7 models for all capacities can be connected to the VS-656DC5.
- \* 2. Do not connect a power supply to the Varispeed F7 AC power supply terminals R/L1, S/L2, and T/L3.
- \* 3. For cooling fan terminals  $r/l_1$  and  $s/l_2$  of the Varispeed F7 200 V class 37 to 75 kW models, remove the jumper wiring between  $r/l_1$  and R/L1, and between  $s/l_2$  and S/L2. Then take the power supply for  $r/l_1$  and  $s/l_2$  from the VS-656DC5 primary power supply line. For cooling fan terminals  $r/l_1$  and  $s/l_2$  of the Varispeed F7 400 V class 75 to 160 kW models, remove the jumper wiring between  $r/l_1$  and R/L1, and between  $s/l_2$  and S/L2. Then take the power supply for  $r/l_1$  and  $s/l_2$  from the VS-656DC5 primary power supply line.
- \* 4. Be sure to use the specified AC reactor and harmonics filter for the VS-656DC5, to avoid abnormal operations.

- \* 5. Set up a sequence whereby the VS-656DC5 starts operation and then the Varispeed F7 starts after the power supply is turned on, and the power supply is turned off after the Varispeed F7, the motor, and the VS-656DC5 are stopped, in this order.  
Operating the Varispeed F7 without starting the VS-656DC5, or turning off the power supply while the VS-656DC5 is running may cause the VS-656DC5 to malfunction.
- \* 6. Refer to *Interlocking with Inverters* in *Appendix B PRECAUTIONS ON VS-656DC5 APPLICATION* for details about using an interlock with an Inverter.
- \* 7. For models CIMR-D5A2022 to -D5A2075 of the 200 V class and CIMR-D5A4022 to -D5A4160 of the 400 V class, the wiring was done prior to shipment. Connections are not needed for CIMR-D5A2015 of the 200 V class and CIMR-D5A4015 of the 400 V class.  
The terminals  $r/\ell_1$  and  $\Delta/\ell_2$  in the above diagram are the terminal names for 200 V class VS-656DC5 with 37 to 75 kW. The terminal names are as follows respectively for each VS-656DC5 capacity:
  - 200 V class 22 kW, 400 V class 22 to 45 kW:  $\Delta/\ell_2$ ,  $t/\ell_3$   
( $\Delta/\ell_2$  and  $\Delta_1/\ell_{21}$ ,  $t/\ell_3$  and  $t_1/\ell_{31}$  are connected respectively.)
  - 400 V class 75 and 160 kW:  $r/\ell_1$ ,  $\Delta_{400}/\ell_{2400}$
- \* 8. When a noise filter is attached on the VS-656DC5 power supply side, use a noise filter of the reactor type (without a capacitor) such as fine met zero-phase reactor, and attach it behind the MCCB at the power supply side. Do not use a capacitor-built-in type noise filter since the harmonic components may overheat or damage the capacitor.
- \* 9. The wiring between the input AC reactor and the VS-656DC5 must be within 10 m.
- \* 10. The DC current bus bar wiring between the VS-656DC5 and the Inverter must be within 5 m.
- \* 11. If installing a circuit breaker or a magnetic contactor on the VS-656DC5 output (DC) side to shut down the power supply in an emergency, observe the following precautions.
  - Be sure to confirm that the charge lamps on the VS-656DC5 and the Inverter are not lit, and then turn on the circuit breaker or contactor. If the circuit breaker or contactor is turned on while power is supplied to the VS-656DC5 and the Inverter, an overcurrent may occur and damage the circuit breaker or contactor.
  - Be sure to confirm that the circuit breaker or contactor is turned on before the power is turned on for the VS-656DC5.

### 3.5 Wiring Precautions

The external interconnection wiring must be performed with following procedures. After completing VS-656DC5 interconnections, be sure to check that the connections are correct. Never use control circuit buzzer check.

#### ■ Control Circuit Wiring

Separate control circuit wiring from main circuit wiring and other power cables.

Separate wiring for control circuit terminals from other control circuits or main circuit wirings.

Wiring distance should be 50 m or less.

Insert the wire into the lower part of the terminal block and connect it tightly with a screwdriver.

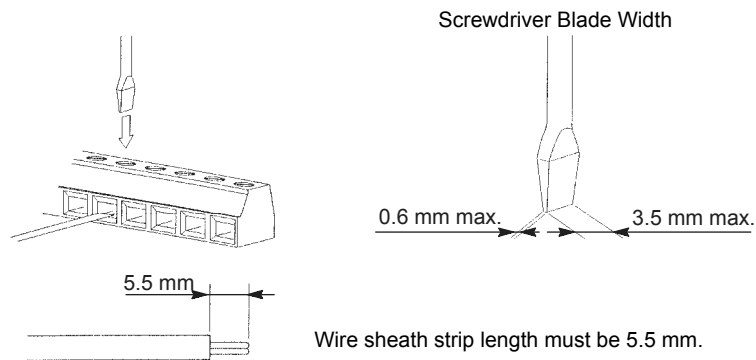


Fig. 9 Control Circuit Terminal Wiring

Use twisted-pair shielded wire for the control circuit wire and connect the shielded sheath to VS-656DC5 terminal E. (Refer to Fig. 10.)

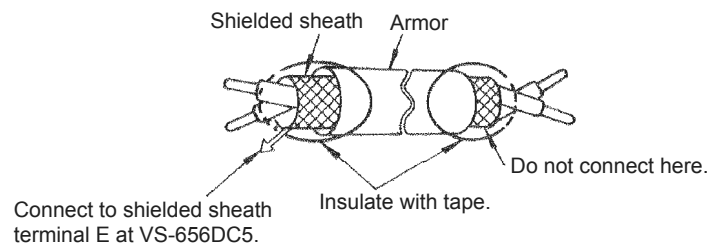


Fig. 10 Shielded Wire Termination



## ■ Ground Wiring

Make sure to ground the ground terminal  $\oplus$ . (200 V class: Ground to 100  $\Omega$  or less, 400 V class: Ground to 10  $\Omega$  or less).

Do not share the ground wire with other devices, such as welding machines or power tools. Separate the ground wires from the wirings for power tools.

Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire.

When using more than one VS-656DC5, be careful not to loop the ground wire.

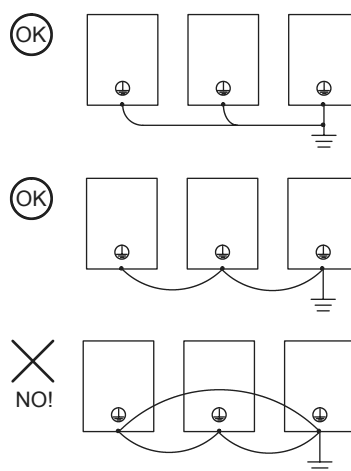


Fig. 11 Ground Wiring

### 3.6 Wiring Main Circuit Terminals

#### ■ Required Wire Size

Select wires to be used for wiring from the following table.

Circuit	VS-656DC5 CIMR-D5A	Terminal Symbol	Terminal Screw	Wire Size * mm <sup>2</sup> (AWG)	Wire Type
Control	Common to all models	1 to 11, 18 to 23, 25 to 27, 35 to 37	–	Twisted wire 0.5 to 1.25 (20 to 16) Single 0.5 to 1.25 (20 to 16)	<ul style="list-style-type: none"> <li>Twisted-pair shielded wires</li> <li>Shielded polyethylene-covered, vinyl sheath cable (manufactured by Hitachi Cable, Ltd. or equivalent)</li> </ul>
		E (G), 12	M3.5	0.5 to 2 (20 to 14)	

\* Wire size is determined by 75 °C temperature-rated copper wire, and assuming external wiring of single 3-core wires at an ambient temperature of 30 °C.

#### ■ Applicable Wire Sizes and Closed-loop Connectors

Select the appropriate wires and closed-loop connectors from *Tables 3 to 5*.

Table 3 200 V Class Wire Size

Converter Model CIMR-□	Terminal Symbol	Terminal Screw	Tightening Torque N·m	Possible Wire Size* mm <sup>2</sup> (AWG)	Recom- mended Wire Size mm <sup>2</sup> (AWG)	Wire Type
D5A2015	R/L1, S/L2, T/L3, ⊕, ⊕, ⊖, ⊖	M8	8.2 to 10.2	14 to 30 (6 to 2)	22 (4)	Power cable: 600 V vinyl sheathed wire or equivalent
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2 to 5.5 (14 to 10)	–	
	⊖	M6	4.0 to 5.0	8 (8)	8 (8)	
D5A2022	R/L1, S/L2, T/L3, ⊕, ⊕, ⊖, ⊖	M8	8.2 to 10.2	30 to 70 (2 to 2/0)	38 (1)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2 to 5.5 (14 to 10)	–	
	⊖	M6	4.0 to 5.0	14 (6)	14 (6)	
D5A2037	R/L1, S/L2, T/L3	M10	18 to 23	50 to 100 (1/0 to 4/0)	80 (3/0)	
	⊕, ⊕, ⊖, ⊖	M10	18 to 23	50 to 70x2P (1/0 to 2/0x2P)	30x2P (2x2P)	
	⊖	M10	18 to 23	22 (4)	22 (4)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2.0 to 5.5 (14 to 10)	–	

Table 3 200 V Class Wire Size (cont'd)

Converter Model CIMR-□	Terminal Symbol	Terminal Screw	Tightening Torque N·m	Possible Wire Size* mm <sup>2</sup> (AWG)	Recommended Wire Size mm <sup>2</sup> (AWG)	Wire Type
D5A2075	R/L1, S/L2, T/L3	M12	31.5 to 39.5	150 to 200 (300 to 400 kcmil)	200 (400 kcmil)	Power cable: 600 V vinyl sheathed wire or equivalent
	⊕, ⊕, ⊖, ⊖	M12	31.5 to 39.5	38x2P to 100x2P (1x2P to 4/0x2P)	70x2P (2/0x2P)	
	⊕	M12	31.5 to 39.5	50 (1/0)	50 (1/0)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2.0 to 5.5 (14 to 10)	–	

\* Wire size is determined by 75 °C temperature-rated copper wire, and assuming external wiring of single 3-core wires at an ambient temperature of 30 °C.

Table 4 400 V Class Wire Size

Converter Model CIMR-□	Terminal Symbol	Terminal Screw	Tightening Torque N·m	Possible Wire Size* mm <sup>2</sup> (AWG)	Recommended Wire Size mm <sup>2</sup> (AWG)	Wire Type
D5A4015	R/L1, S/L2, T/L3, ⊕, ⊕, ⊖, ⊖	M5	2 to 2.5	5.5 to 14 (10 to 6)	8 (8)	Power cable: 600 V vinyl sheathed wire or equivalent
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2 to 5.5 (14 to 10)	–	
	⊕	M6	4.0 to 5.0	8 (8)	8 (8)	
D5A4022	R/L1, S/L2, T/L3, ⊕, ⊕, ⊖, ⊖	M6	3.6 to 5.1	14 to 22 (6 to 4)	14 (6)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2 to 5.5 (14 to 10)	–	
	⊕	M6	4.0 to 5.0	8 (8)	8 (8)	
D5A4030	R/L1, S/L2, T/L3, ⊕, ⊕, ⊖, ⊖	M8	8.2 to 10.2	14 to 70 (6 to 2/0)	22 (4)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2 to 5.5 (14 to 10)	–	
	⊕	M6	4.0 to 5.0	8 to 14 (8 to 6)	8 (8)	
D5A4045	R/L1, S/L2, T/L3, ⊕, ⊕, ⊖, ⊖	M8	8.2 to 10.2	30 to 70 (2 to 2/0)	38 (1)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2 to 5.5 (14 to 10)	–	
	⊕	M6	4.0 to 5.0	14 (6)	14 (6)	

Table 4 400 V Class Wire Size (cont'd)

Converter Model CIMR-□	Terminal Symbol	Terminal Screw	Tightening Torque N·m	Possible Wire Size* mm <sup>2</sup> (AWG)	Recommended Wire Size mm <sup>2</sup> (AWG)	Wire Type
D5A4075	R/L1, S/L2, T/L3	M10	18 to 23	50 to 100 (1/0 to 4/0)	80 (3/0)	Power cable: 600 V vinyl sheathed wire or equivalent
	⊕, ⊕, ⊖, ⊖	M10	18 to 23	50 to 70x2P (1/0 to 2/0x2P)	30x2P (2x2P)	
	⊕	M8	9.0 to 11.0	22 (4)	22 (4)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2.0 to 5.5 (14 to 10)	–	
D5A4160	R/L1, S/L2, T/L3	M12	31.5 to 39.5	150 to 200 (300 to 400 kcmil)	200 (400 kcmil)	
	⊕, ⊕, ⊖, ⊖	M12	31.5 to 39.5	38x2P to 100x2P (1x2P to 4/0x2P)	70x2P (2/0x2P)	
	⊕	M8	9.0 to 11.0	50 (1/0)	50 (1/0)	
	r1/ℓ11, Δ1/ℓ21, t1/ℓ31	M4	1.2 to 1.4	2.0 to 5.5 (14 to 10)	–	

\* Wire size is determined by 75 °C temperature-rated copper wire, and assuming external wiring of single 3-core wires at an ambient temperature of 30 °C.

## ■ Closed-loop Connector Sizes

Table 5 Closed-loop Connector Sizes (JIS C 2805) (For 200 V/400 V Classes)

Wire Size (mm <sup>2</sup> )	Terminal Screw	Closed-loop Connector Nominal Size
0.5	M3.5	1.25 to 3.5
0.75	M4	1.25 to 4
1.25		
2	M4	2 to 4
	M5	2 to 5
3.5	M4	3.5 to 4
	M5	3.5 to 5
5.5	M4	5.5 to 4
	M5	5.5 to 5
8	M5	8 to 5
	M6	8 to 6
14	M6	14 to 6
22	M8	22 to 8
38	M8	38 to 8
38	M10	38 to 10
60		60 to 10
80		80 to 10
100		100 to 10
100	M12	100 to 12
150		150 to 12
200		200 to 12

### NOTE

Determine the wire size for the main circuit so that line voltage drop is within 2% of the rated voltage.

Line voltage drop is calculated as follows:

(If there is a possibility of excessive voltage drop, use a larger wire suitable to the required length.)

$$\text{Line voltage drop (V)} = \sqrt{3} \times \text{wire resistance } (\Omega/\text{km}) \times \text{wire length (m)} \times \text{current (A)} \times 10^{-3}$$

### 3.7 External Terminals

#### ■ Main Circuit Terminal Functions

Table 6 Main Circuit Terminal Functions

Terminal Symbol		Description
R/L1 S/L2 T/L3	VS-656DC5 Main Circuit Input	Main circuit AC power supply input terminal for the VS-656DC5
⊕, ⊖	VS-656DC5 Main Circuit Output	Main circuit DC output terminal for the VS-656DC5 <ul style="list-style-type: none"> <li>• Connects to the Inverter's DC power supply voltage input terminals. Two terminals are provided for both ⊕ and ⊖.</li> </ul>
r1/ℓ11 Δ1/ℓ21 t1/ℓ31	Power Supply Voltage Detection	Detects the phase sequence and the voltage level. <ul style="list-style-type: none"> <li>• Connect to the power side of the input reactor.</li> </ul>
r/ℓ1 Δ/ℓ2	Power Input for FAN and MC	Supplies power for the cooling fan and inrush current prevention MC of the VS-656DC5. <ul style="list-style-type: none"> <li>• Terminals may not be provided for some VS-656DC5s depending on their capacities.</li> <li>• The power supply voltage jumper in the VS-656DC5 must be set depending on the voltage value to be supplied.</li> </ul>

#### ■ Control Circuit Terminal Functions

Table 7 Control Circuit Terminal Functions

Terminal Name *1	Signal Name	Function	Signal Level	
Sequence Input	1	RUN-SB	VS-656DC5 starts operation at "Closed." One-shot trigger inputs are available: Once the data is input, the VS-656DC5 keeps running even at "Open." To start the VS-656DC5 operation, set terminal 2 to "Closed." *2	24 VDC 8 mA Photocoupler isolation
	2	STOP	VS-656DC5 stops at "Open."	
	3	External Fault	–	
	4	Fault Reset	*2	
	5 - 7	Multi-function Contact Input Terminal	Set to "Unused" prior to shipment. Constants H1-03 to H1-06 can be used for the setting.	
	8	External Baseblock	Baseblock at "Closed."	
	11	Sequence Common	–	
	35	Photocoupler Internal Common	–	
	36	+24-V Power Sup- ply for Sequence	–	
	12	Shielded Sheath Wire	–	

Table 7 Control Circuit Terminal Functions (cont'd)

Terminal Name *1		Signal Name	Function	Signal Level
Photocoupler Output	25 - 27	Multi-function Photocoupler Open-collector Output	Set to "CREADY (Converter Ready)" prior to shipment.	48 VDC 80 mA or less
	26 - 37		Set to "MC Operating (MCON)" prior to shipment.	
Relay Output	18 - 20 19 - 20	FAULT Output (Transfer Contact)	Outputs when a fault is detected. Terminal 18-20: Closed during fault detection Terminal 19-20: Open during fault detection	250 VAC 10 mA or more 1 A or less 30 VDC 10 mA or more 1 A or less Minimum permissible load: 5 VDC, 10 mA *3
	9 - 10		Multi-function Contact Output	
Analog Output	21	Multi-function Analog Output	Set to "Input power (AC Side Power)" prior to shipment.	-10 V to +10 VDC or less
	23		Set to "Input current (Input Current)" prior to shipment.	
	22	Multi-function Analog Common	-	

\* 1. Indicates the terminal number of the control card.

\* 2. The input signals excluding RUN-SB signal are status signals. (RUN-SB signal is a rising trigger signal and held internally.) When RUN-SB and fault reset signals are input, the input must be held at least 40 ms.

\* 3. Use the photocoupler outputs when the minimum permissible load is 5 VDC or less and 10 mA or less.

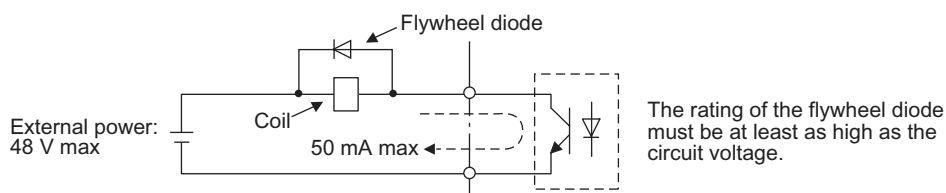


Fig. 12 Flywheel Diode Connection

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## 4 OPERATION

### WARNING

- Only turn on the input power supply after attaching the front cover or the terminal cover. Do not remove the cover while current is flowing.  
Failure to observe this warning may result in an electric shock.
- Never operate the Digital Operator or other switches when your hand is wet.  
Failure to observe this warning may result in an electric shock.
- Never touch the terminals while current is flowing, even if the VS-656DC5 stops.  
Failure to observe this warning may result in an electric shock.

### CAUTION

- Never touch the radiation fins (heatsink) or input reactor since the temperature is very high.  
Failure to observe this caution may result in harmful burns to the body.
- The VS-656DC5 is factory set to the suitable settings. Do not change the settings unnecessarily.  
Failure to observe this caution may result in damage to the unit.

### 4.1 Checkpoints before Turning On the Power Supply

Check the following before turning on the power supply.

- Check that the power supply voltage is correct.  
200 V class: 200 to 220 VAC, 50 Hz  
                  200 to 230 VAC, 60 Hz  
400 V class: 380 to 460 VAC, 50/60 Hz
- Make sure that the VS-656DC5 and the Inverter are connected correctly.
- Make sure that the phase sequence of the main circuit terminals (R/L1, S/L2, T/L3) and the power supply voltage detection terminals (r1/ℓ11, s1/ℓ21, t1/ℓ31) are correct.
- Make sure that the VS-656DC5 control circuit terminals are connected to other control devices correctly.
- Set the run command of the VS-656DC5 and the Inverter to off.



## 4.2 Setting the Power Supply Voltage Jumper (For 400 V Class VS-656DC5 with 22 kW or More)

Set the power supply voltage jumper for 400 V class VS-656DC5 with 22 kW or more. Insert the jumper into the voltage connector nearest to the actual power supply voltage.

Incorrect connector setting may negatively impact the performance and credibility of the VS-656DC5.

The jumper is set to 440 V prior to shipment. If the power supply voltage other than 440 V is to be used, use the following procedure to change the setting.

1. Turn off the power supply and wait for at least five minutes before removing the front cover.
2. Remove the front cover.
3. Insert the jumper at the position for the voltage supplied to the VS-656DC5 (Refer to *Fig. 13*).
4. Attach the front cover.

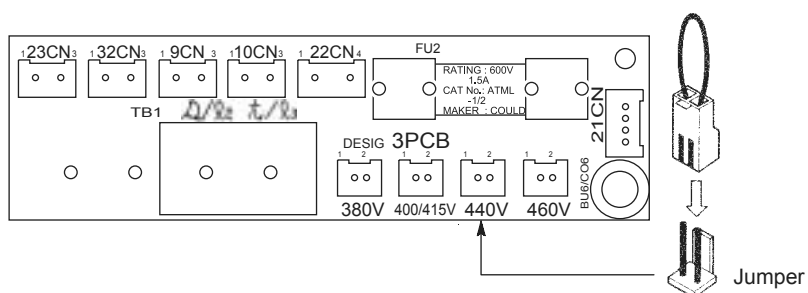


Fig. 13 Setting the Power Supply Voltage  
(For 400 V Class VS-656DC5 with 22 kW)

## 4.3 Using the Digital Operator

This section describes the component names and functions of the Digital Operator. The component names and functions are shown in *Fig. 14* and Key functions are described in *Table 8*.

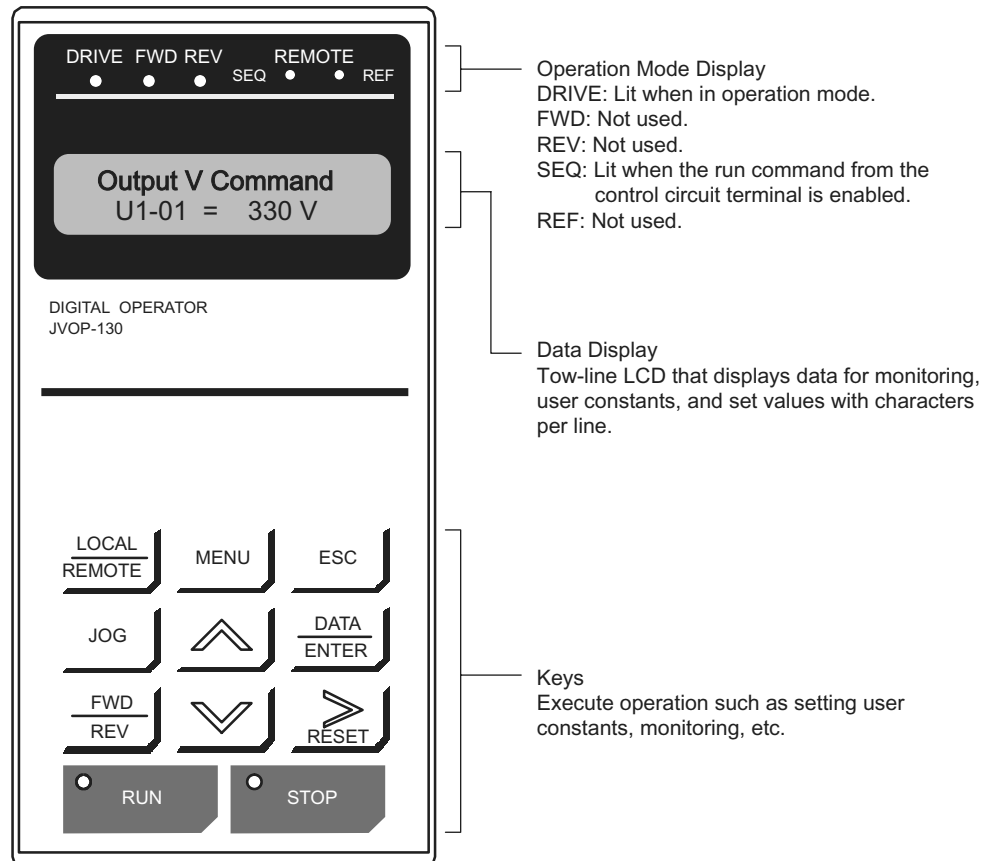













Fig. 14 Digital Operator Component Names and Functions

Table 8 Key Functions

Key	Name	Function
	LOCAL/REMOTE Key	Switches between operation (LOCAL) via the Digital Operator and control circuit terminal (REMOTE) operation. This Key can be enabled or disabled by setting a user constant (o2-01).
	MENU Key	Displays menus.
	ESC Key	Returns to the status before the DATA/ENTER Key was pressed.
	JOG Key	Not used.
	FWD/REV Key	Not used.
	RESET Key	Sets the number of digits for user constant settings. Also acts as the reset Key when a fault has occurred.
	Increment Key	Selects menu items, groups, functions, user constant names, and increments set values.
	Decrement Key	Selects menu items, groups, functions, user constant names, and decrements set values.
	DATA/ENTER Key	Enters menu items, functions, constants, and set values after they are set.
	RUN Key	Starts the VS-656DC5 operation when the VS-656DC5 is in operation with the Digital Operator.
	STOP Key	Stops the VS-656DC5 operation when the VS-656DC5 is in operation with the Digital Operator. This Key can be enabled or disabled by setting a user constant (o2-02) when operating from the control circuit terminal.

Note: Except in diagrams, Keys are referred to using the Key names listed in *Table 8*.

## ■ Modes

This section describes the VS-656DC5 monitor modes, switching between modes, and accessing/setting user constants.

### VS-656DC5 Modes

The VS-656DC5 user constants and monitoring functions have been organized in groups called modes that make it easier to read and set user constants.

The VS-656DC5 is equipped with 4 modes, as shown in *Table 9*.

Table 9 Modes

Mode	Primary function(s)
Operation mode	The VS-656DC5 can be run in this mode. Use this mode when monitoring values such as DC voltage feedback or power supply frequency, displaying fault information, or displaying the fault history.
Initialize mode	Use this mode when selecting the language displayed on the Digital Operator, selecting the access level for reading/setting user constants, or initializing the user constants. The language to be displayed on the Digital Operator is set to English (A1-00 = 0) prior to shipment.
Programming mode	Use this mode when reading/setting the user constants required for operation. The program-mode functions are subdivided into the following groups: <ul style="list-style-type: none"><li>• Application: Operation mode selection</li><li>• Tuning: Acceleration time, AVR, etc.</li><li>• Option: Settings for Optional Cards</li><li>• Terminal: Settings for sequential I/O and analog I/O</li><li>• Protection: Settings for the motor and VS-656DC5 protection functions</li><li>• Operator: Selection of the Digital Operator's display and Key functions</li></ul>
Modified constants mode	Use this mode to read/set user constants that have been changed from their factory-set values.

## Switching Modes

Once the VS-656DC5 has been put into operation mode by pressing the Menu Key, the Increment and Decrement Keys can be pressed to switch to other modes. Press the DATA/ENTER Key to read/set the user constants in each mode.

Press the ESC Key to return to the mode display from the user constant display.

Press the DATA/ENTER Key twice to write a constant and then press the ESC Key to return to the mode display. This is the most Basic operation, so you should remember it.

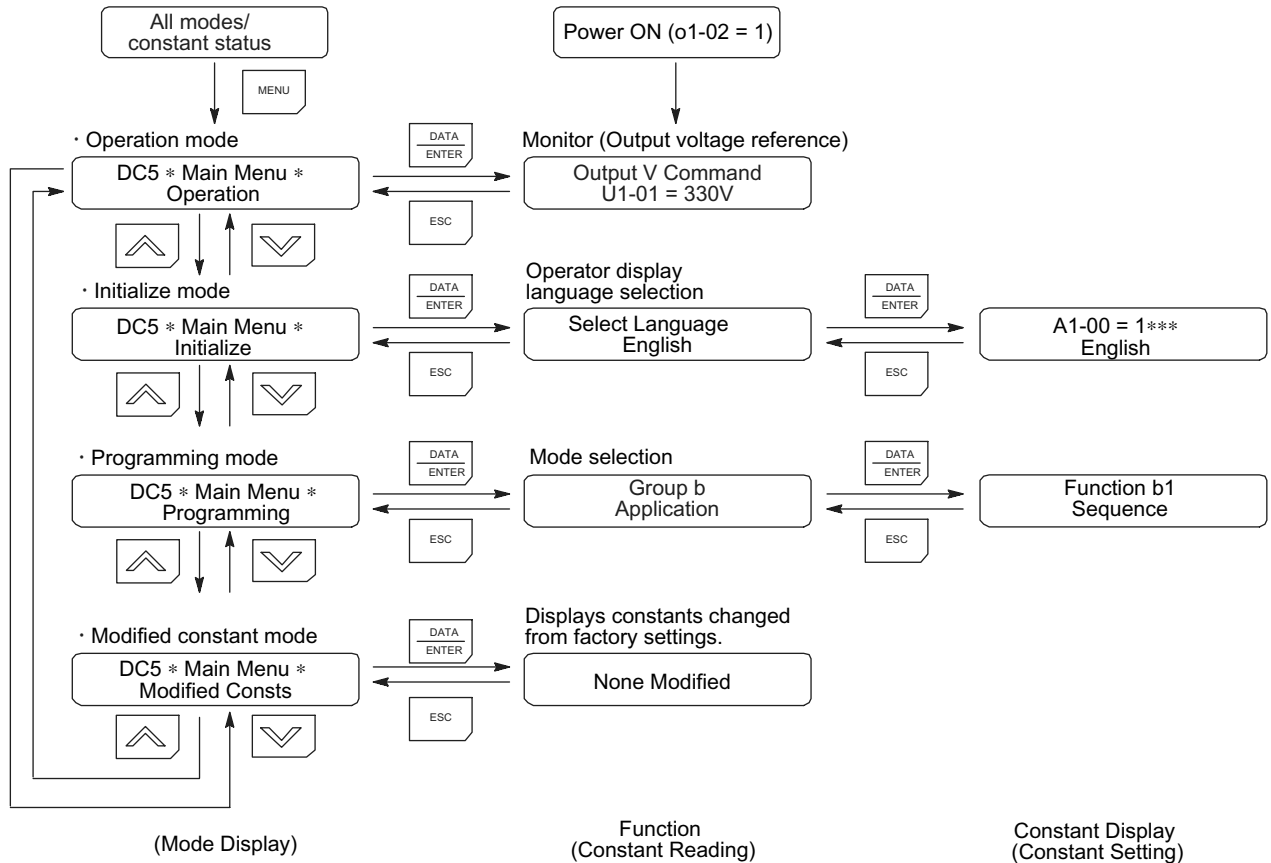


Fig. 15 Switching Modes

### IMPORTANT











When running the VS-656DC5 after using Digital Operator, press the MENU Key to enter the operation mode and then press the DATA/ENTER Key from the operation mode display to bring up the monitor display. Run commands cannot be received from any other display. (Monitor display in the operation mode appears when the power is turned on.)

◀ **EXAMPLE** ▶

## Setting a User Constant

The group level will be displayed when the DATA/ENTER Key is pressed at the programming mode display.

Use the following procedure to set a constant.

Step	Key Sequence	Digital Operator Display	Remarks	
1		DC5 * Main Menu * Operation	Changed to constant reading (function) level.	
2	 Press twice.	DC5 * Main Menu * Programming		
3		Group b Application		
4		Function b1 Sequence		
5		Reference Source Operator		
6		Run Source Terminals		
7		b1-02 = 1 Terminals		
8		b1-02 = 0 Operator		
9		Entry Accepted		Writes in the new setting.
		Run Source Operator		After a few seconds, the Operator display is as shown on the left.
10		Function b1 sequence		

The constant setting (drive mode is changed from Terminal to Operator with programming mode) has been completed.

## Operation Mode

Operation mode is the mode in which the VS-656DC5 can be operated.

Many user constants can't be changed when the VS-656DC5 is operating. Refer to *A.1 Monitor Constant List* for details.

The following monitor displays are possible in operation mode: The AC power supply frequency, current or voltage, as well as fault information and the fault history.

**IMPORTANT**

When running the VS-656DC5 after using Digital Operator, press the MENU Key to enter the operation mode and then press the DATA/ENTER Key from the operation mode display to bring up the monitor display. Run commands cannot be received from any other display. (Monitor display in the operation mode appears when the power is turned on.)

## ■ Operations in Operation Mode

Key operations in operation mode are shown in Fig. 16.

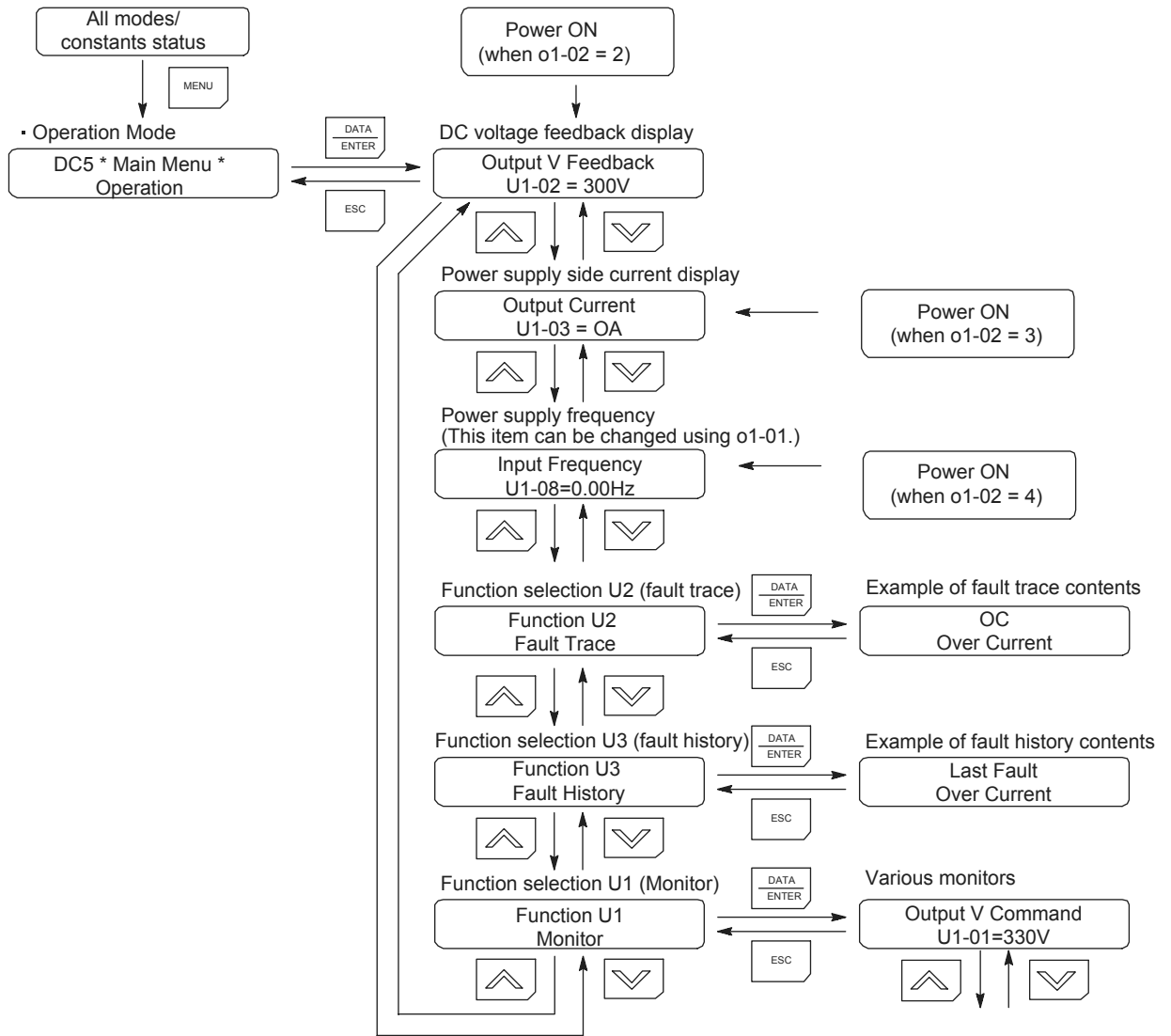


Fig. 16 Operations in Operation Mode

## 4.4 Power On/Off Sequence

Refer to *Fig. 17* when building a power on/off sequence for the VS-656DC5.

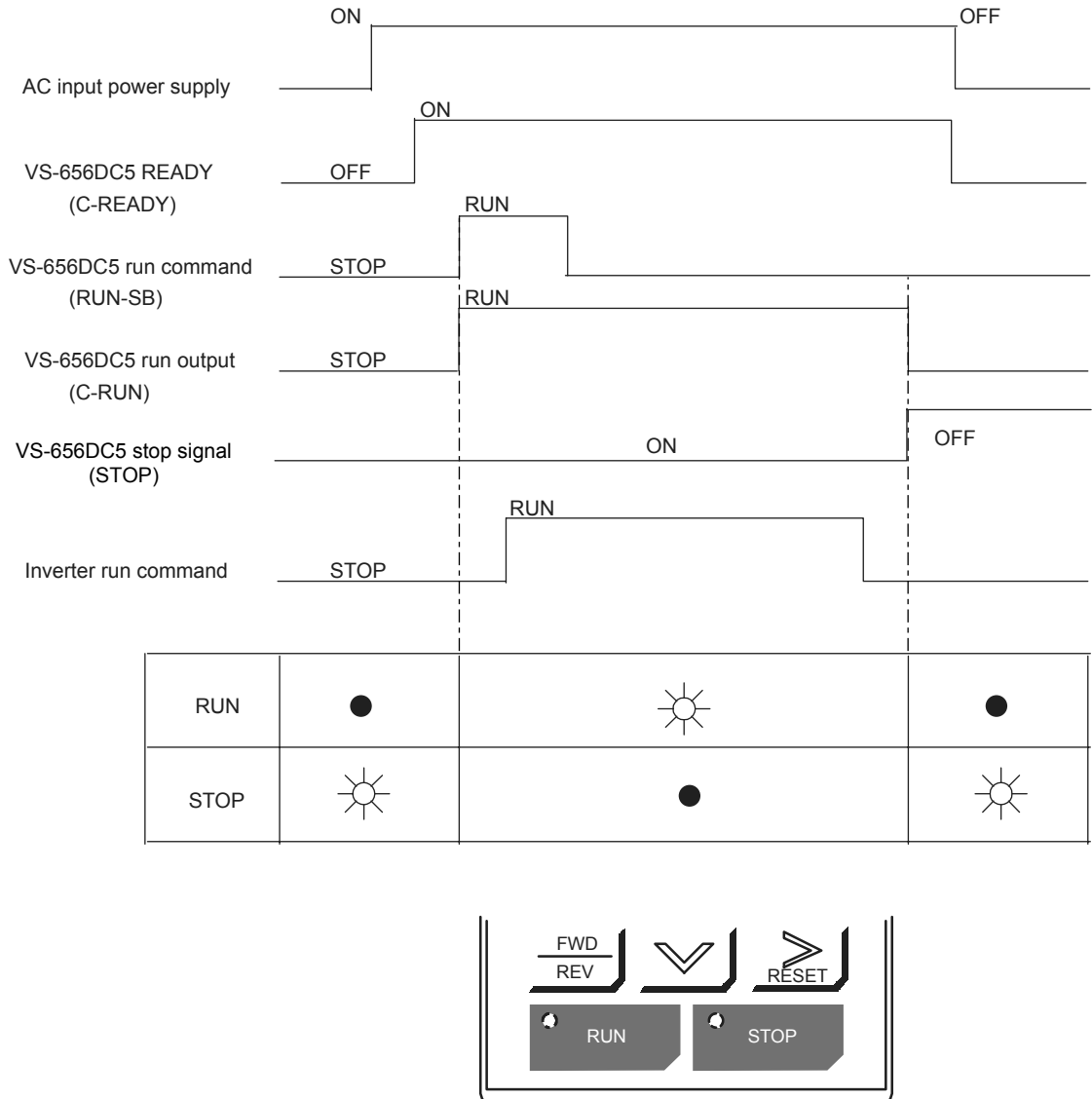


Fig. 17 Power Supply On/Off Sequence

Check the following when using the VS-656DC5.

- Run commands of the VS-656DC5 should be turned on after turning on the power supply and then confirming that the VS-656DC5 is READY.
- Turn on the run command of the Inverter after confirming that the VS-656DC5 is running.
- To stop the VS-656DC5, input the VS-656DC5 stop signal after confirming that the run command of the Inverter is turned off and then the motor has stopped.
- Turn the power off after the run output of the VS-656DC5 is off.



## 5 MAINTENANCE AND INSPECTION

### WARNING

- Never touch high-voltage terminals in the VS-656DC5.  
Failure to observe this warning may result in an electric shock.
- Perform maintenance or inspection only after verifying that the CHARGE LED goes off, after the main circuit power supply is turned off.  
The capacitors are still charged and can be dangerous.
- Only authorized personnel should be permitted to perform maintenance, inspections, or parts replacement.  
[Remove all metal objects (watches, bracelets, etc.) before operation.]  
(Use tools which are insulated against electric shock.)  
Failure to observe this warning may result in an electric shock.
- Never modify the product.  
Failure to observe this warning may result in an electric shock or personal injury.

### CAUTION

- A CMOS IC is used in the control board. Handle the control board and CMOS IC carefully. The CMOS IC can be destroyed by static electricity if touched directly.  
The CMOS IC may be destroyed by static electricity if touched directly.
- Do not change the wiring, or connect/disconnect the connectors while power is applied to the circuit.  
Failure to observe this caution may result in personal injury.
- Install adequate branch circuit short circuit protection per applicable codes.  
Failure to comply could result in damage to the VS-656DC5.  
The VS-656DC5 is suitable for circuits capable of delivering not more than 100,000 RMS symmetrical Amperes, 230 VAC maximum (200 V Class) and 460 VAC maximum (400 V Class).
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.  
Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.  
If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

## 5.1 Maintenance Period

The maintenance period of the VS-656DC5 is as follows.

Maintenance period: Within 18 months of shipping from the factory or within 12 months of being delivered to the final user, whichever comes first.

## 5.2 Daily Inspection

Check the following items with the system in operation.

- There should be no abnormal heat generation.
- The ambient temperature should not be too high.
- The cooling fan on the VS-656DC5 should be operating normally.

## 5.3 Periodic Inspection

Check the following items during periodic maintenance.

Always turn off the power supply before beginning inspection. Confirm that the LED indicators on the front cover have all turned off, and then wait at least five minutes have elapsed before beginning the inspection. Be sure not to touch terminals right after the power has been turned off. Doing so may result in an electric shock.

Table 10 Periodic Inspections

Item	Inspection	Corrective Procedure
External terminals, mounting bolts, connectors, etc.	Are all screws and bolts tight?	Tighten loose screws and bolts firmly.
	Are connectors tight?	Reconnect the loose connectors.
Radiation Fin (Heatsink)	Are the fins dirty or dusty?	Clean off any dirt and dust with an air gun using dry air at a pressure of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (4 to 6 kg·cm <sup>2</sup> ).
PCBs	Is there any conductive dirt or oil mist on the PCBs?	Clean off any dirt and dust with an air gun using dry air at a pressure of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (4 to 6 kg·cm <sup>2</sup> ). Replace the boards if they cannot be made clean.
Cooling fan	Is there any abnormal noise or vibration or has the total operating time exceeded 20,000 hours?	Replace the cooling fan.
Power elements	Is there any dirt or dust on the elements?	Clean off any dirt and dust with an air gun using dry air at a pressure of $39.2 \times 10^4$ to $58.8 \times 10^4$ Pa (4 to 6 kg·cm <sup>2</sup> ).
Smoothing capacitor	Are there any irregularities, such as discoloration or odor?	Replace the capacitor or VS-656DC5.

## 5.4 Periodic Maintenance of Parts

The VS-656DC5 is configured of many parts, and these parts must be operating properly in order to make full use of the VS-656DC5 functions.

Among the electronic components, there are some that require maintenance depending on their usage conditions. In order to keep the VS-656DC5 operating normally over a long period of time, it is necessary to perform periodic inspections and replace parts according to their service life.

When replacing parts, be careful not to drop any, such as screws, inside the VS-656DC5. Failure to observe this caution may result in a short-circuit and a fire.

Periodic inspection standards vary depending the installation environment and usage conditions of the VS-656DC5. The VS-656DC5's maintenance periods are noted below. Keep them as reference.

Table 11 Part Replacement Guidelines

Part	Standard Replacement Period	Replacement Method
Smoothing capacitor	5 years	Replace with new part. (Determine need by inspection.)
Breaker relays	–	Determine need by inspection.
Fuses	10 years	Replace with new part.
Aluminum capacitors on PCBs	5 years	Replace with new board. (Determine need by inspection.)
Cooling fan	2 to 3 years	Replace with new part.

Note: Usage conditions are as follows:

Ambient temperature: Yearly average of 30 °C

Load factor: 80% max.

Operating rate: 12 hours max. per day

## 6 TROUBLESHOOTING

### 6.1 Fault Detection

When the VS-656DC5 detects a fault, the fault code is displayed on the Digital Operator, the fault contact output operates.

When a fault has occurred, refer to *Table 12* to identify and correct the cause of the fault.

Use one of the following methods to reset the fault when restarting the VS-656DC5:

- Turn on the fault reset signal.  
[A multi-function input H1-02 is set to “Fault Reset (set value: 14)” as the initial value.]
- Press the RESET Key on the Digital Operator.
- Turn the main circuit power supply off and then on again.

Table 12 Fault Displays and Troubleshooting

Fault Display	Meaning	Probable Causes	Corrective Actions
No display	Nothing appears on the Digital Operator.	The wiring is not correct.	Check the input wiring.
		Incorrect Digital Operator connection	<ul style="list-style-type: none"> <li>• Connect the Digital Operator again.</li> <li>• Replace the Digital Operator.</li> </ul>
		The main circuit fuse (input AC fuse and DC fuse) and control power supply fuse are blown.	Replace the VS-656DC5 after correcting its cause.
PUF IGBT, Fuse Fault	Fuse Blown The fuse (input AC fuse and DC fuse) in the main circuit is blown.	<ul style="list-style-type: none"> <li>• The main transistor has failed because of a short-circuit or ground fault at the VS-656DC5 input or output.</li> </ul>	<ul style="list-style-type: none"> <li>• Check for short-circuit or ground fault at the input or output side.</li> <li>• Replace the VS-656DC5 after correcting the cause.</li> </ul>
UV1 DC Bus Undervolt	<b>Main Circuit Undervoltage</b> The main circuit DC voltage is below the undervoltage detection level (L2-05) and the undervoltage status lasts longer than the momentary power loss ride thru time. 200 V class: Approx. 190 VDC or less 400 V class: Approx. 380 VDC or less	<ul style="list-style-type: none"> <li>• An open-phase occurred with the input power supply.</li> <li>• A momentary power loss exceeding the momentary power loss time occurred.</li> <li>• The wiring terminals for the input power supply are loose.</li> <li>• The voltage fluctuations in the input power supply are too large.</li> </ul>	Reset the fault after correcting its cause.
	<b>Input Undervoltage</b> Input undervoltage was detected during operation. 200 V class: Approx. 150 VAC or less 400 V class: Approx. 300 VAC or less	<ul style="list-style-type: none"> <li>• There is a fault to the equipment at the power side.</li> <li>• There is a fault to the power supply.</li> <li>• The voltage detection circuit at the power side is faulty.</li> </ul>	<ul style="list-style-type: none"> <li>• Check the wiring of the equipment at the power side.</li> <li>• Adjust the power supply voltage.</li> </ul>
UV2 CTL PS Undervolt	<b>Control Power Fault</b> The control power supply voltage dropped.	–	<ul style="list-style-type: none"> <li>• Turn off and then on the power supply.</li> <li>• Replace the VS-656DC5 if the fault continues to occur.</li> </ul>
UV3 MC Answerback	<b>Inrush Prevention Circuit Fault</b> A fault occurred in the inrush prevention circuit.	–	<ul style="list-style-type: none"> <li>• Turn off and then on the power supply.</li> <li>• Replace the VS-656DC5 if the fault continues to occur.</li> </ul>

Table 12 Fault Displays and Troubleshooting (cont'd)

Fault Display	Meaning	Probable Causes	Corrective Actions
FDEV Frequency Fault	Power Supply Frequency Fault Power supply frequency exceeded the power supply frequency limit (F1-10).	<ul style="list-style-type: none"> <li>The voltage detection circuit at the power side is faulty.</li> </ul>	<ul style="list-style-type: none"> <li>Replace the VS-656DC5 if the fault continues to occur.</li> </ul>
SRC Vin Fault	Power Supply Phase Rotation Fault Phase rotation of the input side changed after the control power supply was turned on.		
GF Ground Fault	Ground Fault The ground fault current at the VS-656DC5 input side exceeded approx. 50% of the VS-656DC5 rated power.	<ul style="list-style-type: none"> <li>A ground fault can be caused by motor burn damage, worn insulation, or a damaged cable.</li> <li>The wiring (r1, <math>\angle</math>1, t1) of the voltage detection circuit at the power side differs from the wiring (R, S, T) of the main circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Check the wiring.</li> <li>Reset the fault after correcting its cause.</li> </ul>
OC Overcurrent	Overcurrent The input current of the VS-656DC5 exceeded the overcurrent detection level (200% of rated current).	<ul style="list-style-type: none"> <li>A short-circuit occurred at the output.</li> <li>Power supply drop</li> <li>The wiring (r1, <math>\angle</math>1, t1) of the voltage detection circuit at the power side differs from the wiring (R, S, T) of the main circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Improve the power supply.</li> <li>Check the wiring.</li> <li>Reset the fault after correcting its cause.</li> </ul>
OV DC Bus Overvolt	Overvoltage The main circuit voltage exceeded the overvoltage detection level. 200 V class: Approx. 400 VDC or more 400 V class: Approx. 800 VDC or more	The regenerative energy from the motor is too large.	Adjust the regenerative load.
		The power supply voltage is too high.	Decrease the voltage so it is within specifications.
		The wiring (r1, $\angle$ 1, t1) of the power supply voltage detection circuit differs from the wiring (R, S, T) of the main circuit.	Decrease the voltage so it is within specifications.
OH(OH1) Heatsnk Over temp	Cooling Fin Overheating The temperature of the VS-656DC5 cooling fins exceeded the setting in L8-02 or 105 °C. OH: The temperature exceeded the setting in L8-02 (Stopping method can be changed by L8-03.). OH1: The temperature exceeded 105 °C (Stopping method: Coast to stop).	The ambient temperature is too high.	Install a cooling unit.
		There is a heat source nearby.	Remove the heat source.
		The VS-656DC5 cooling fan has stopped.	Replace the cooling fan. (Contact your Yaskawa representative.)
	Inrush Prevention Circuit Fault (For 15 kW only) A fault occurred in the inrush prevention circuit.	The inrush current control relay is faulty and remains open.	<ul style="list-style-type: none"> <li>Turn off and then on the power supply.</li> <li>Replace the VS-656DC5 if the fault continues to occur.</li> </ul>
OL1 Conv Overloaded	VS-656DC5 Overload The VS-656DC5 overload protection function has operated based on the internal electronic thermal valve.	<ul style="list-style-type: none"> <li>The load is too large.</li> <li>The VS-656DC5 capacity is too small.</li> </ul>	<ul style="list-style-type: none"> <li>Check the size of the load.</li> <li>Replace the VS-656DC5 with one that has a larger capacity.</li> </ul>

Table 12 Fault Displays and Troubleshooting (cont'd)

Fault Display	Meaning	Probable Causes	Corrective Actions
EF3 External Fault 3	External Fault (Input Terminal 3)	An "external fault" was input from a multi-function input terminal.	<ul style="list-style-type: none"> <li>• Reset external fault inputs to the multi-function inputs.</li> <li>• Remove the cause of the external fault.</li> </ul>
EF4 External Fault 4	External Fault (Input Terminal 4)		
EF5 External Fault 5	External Fault (Input Terminal 5)		
EF6 External Fault 6	External Fault (Input Terminal 6)		
EF7 External Fault 7	External Fault (Input Terminal 7)		
EF8 External Fault 8	External Fault (Input Terminal 8)		
CPF00 COM-ERR (OP & INV)	Digital Operator Communications Error 1 Communications with the Digital Operator were not established within 5 seconds after the power was turned on.	The Digital Operator's connector isn't connected properly.	Disconnect the Digital Operator and then connect it again.
		The Inverter's control circuits are faulty.	Replace the Inverter.
CPF01 COM-ERR (OP & INV)	Digital Operator Communications Error 2 After communications were established, there was a communications error with the Digital Operator for more than 2 seconds.	The Digital Operator isn't connected properly.	Disconnect the Digital Operator and then connect it again.
		The Inverter's control circuits are faulty.	Replace the Inverter.
CPF02 BB Circuit Err	Baseblock Circuit Error	–	Turn off and then on the power supply.
		The control circuit is damaged.	Replace the Inverter.
CPF03 EEPROM Error	EEPROM Error	–	Turn off and then on the power supply.
		The control circuit is damaged.	Replace the Inverter.
CPF04 Internal A/D Err	Cpu Internal A/D Converter Error	–	Turn off and then on the power supply.
		The control circuit is damaged.	Replace the Inverter.
CPF05 External A/D Err	Cpu External A/D Converter Error	–	Turn off and then on the power supply.
		The control circuit is damaged.	Replace the Inverter.
CPF06 Option error	Option Card Connection Error	The Option Card is not connected properly.	Turn off the power and insert the Card again.
		The Inverter or Option Card is faulty.	Replace the Option Card or the Inverter.
CPF22 Option Type Err	Communications Option Card Model Code Error	Communications Option Card is faulty.	Replace the Option Card.
CPF24 CONV. A/D error	Converter Card Error	The Converter Card is faulty.	Replace the Converter Card.

## 6.2 Minor Fault Detection

Minor faults are a type of VS-656DC5 protection function that do not operate the fault contact output and are automatically returned to their original status once the cause of the minor fault has been removed.

The Digital Operator display blinks and the minor fault is output from the multi-function outputs.

Take appropriate countermeasures according to the table below.

Table 13 Minor Fault Displays and Troubleshooting

Minor Fault Display	Meaning	Probable Causes	Corrective Actions
UV (blinking) DC Bus Undervolt	<b>Main Circuit Undervoltage</b> The following conditions occurred when there was no Run signal. <ul style="list-style-type: none"> <li>• The main circuit DC voltage was below the main circuit DC voltage detection level (L2-05).</li> <li>• The inrush current limiting contactor opened.</li> <li>• The control power supply voltage when below the undervoltage (input voltage low level).</li> <li>• Frequency detection exceeded the allowable level.</li> <li>• Voltage phase rotation at the input side changed.</li> </ul>	Refer to probable causes for UV1, UV2, UV3, FdEv, and SrC faults.	Refer to probable corrective actions for UV1, UV2, UV3, FdEv, and SrC faults.
OV (blinking) DC Bus Overvolt	<b>Main Circuit Overvoltage</b> The main circuit DC voltage exceeded the overvoltage detection level. 200 V class: Approx. 400 VDC or more 400 V class: Approx. 800 VDC or more	The power supply voltage is too high.	Decrease the voltage so it's within specifications.
OH (blinking) Heatsnk Over temp	<b>Cooling Fin Overheating</b> The temperature of the VS-656DC5 cooling fins exceeded the setting in L8-02.	The ambient temperature is too high.	Install a cooling unit.
		There is a heat source nearby.	Remove the heat source.
		The VS-656DC5 cooling fan has stopped.	Replace the cooling fan. (Contact your Yaskawa representative.)
EF3 (blinking) External Fault 3	External fault (Input terminal 3)	An "External fault" was input from a multi-function input.	<ul style="list-style-type: none"> <li>• Reset external fault inputs to the multi-function inputs.</li> <li>• Remove the cause of the external fault.</li> </ul>
EF4 (blinking)	External fault (Input terminal 4)		
EF5 (blinking)	External fault (Input terminal 5)		
EF6 (blinking)	External fault (Input terminal 6)		
EF7 (blinking)	External fault (Input terminal 7)		
EF8 (blinking)	External fault (Input terminal 8)		

## 6.3 Operation Errors

After the constants have been set, an operation error will occur if there is an invalid setting or a contradiction between two constant settings.

It won't be possible to start the VS-656DC5 until the constants have been set correctly. (The minor fault output and fault contact output will not operate, either.)

When an operation error has occurred, refer to the following table to identify and correct the cause of the errors.

Display	Meaning	Probable Causes
OPE01 kVA Selection	Incorrect VS-656DC5 capacity setting	The VS-656DC5 capacity setting doesn't match the actual VS-656DC5 capacity. (Contact your Yaskawa representative.)
OPE02 Limit	Constant setting range error	The constant setting is outside of the valid setting range. *
OPE03 Terminal	Multi-function input selection error	The setting of the multi-function input (H1-01 to H1-06) is not correct.
ERR EEPROM R/W Err	EEPROM Write Error	A verification error occurred when writing EEPROM. <ul style="list-style-type: none"><li>• Turn off and then on the power supply.</li><li>• Set the constants again.</li></ul>

\* By pressing the ENTER key when OPE02 appears, the setting error constant is displayed on U1-50 as shown below.

Num of Set Err

U1-50 = XX - XX



## 6.4 Informing the VS-656DC5 of a Peripheral Device Fault to Stop the VS-656DC5 (External Fault Function)

The external fault function operates the fault contact output to stop the VS-656DC5 operation when a malfunction or fault occurs in any of the VS-656DC5 peripheral devices. At this time, the Digital Operator displays Efx [External Fault (Input Terminal x)]. “x” of Efx indicates the terminal number to which the external fault signal is input. For example, when an external fault signal is input to terminal 3, the Digital Operator displays EF3.

To use the external fault function, set H1-01 to H1-05 (Multi-function Contact Input Terminals 3 to 7) to 24 to 2F.

Select the values to be set to H1-01 to H1-05 according to the combination of the following three conditions:

- The level of a signal input from the peripheral device
- The external fault detection method
- The operation at external fault detection

The following table shows the combination of the above conditions and the relation with the set value of H1-□□.

Set Value	Input Level *1		Fault Detection Method *2		Selection of Operation	
	NO contact	NC contact	Always detected	Detected during run	VS-656DC5 stopped (fault)	Operation continued (minor fault)
24	✓		✓		✓	
25		✓	✓		✓	
26	✓			✓	✓	
27		✓		✓	✓	
2C	✓		✓			✓
2D		✓	✓			✓
2E	✓			✓		✓
2F		✓		✓		✓

\* 1. Set the input level to whether the fault is to be detected by signal ON or OFF. (NO contact: external fault at ON, NC contact: external fault at OFF)

\* 2. Set the detection method to whether the fault is detected at any time or only during run.  
 Always detected: Detected while the power supply is turned on to the VS-656DC5.  
 Detected during run: Detected only while the VS-656DC5 is running.

## 7 SPECIFICATIONS

Voltage Class		200 V Class				400 V Class					
Model CIMR-D5A□		2015	2022	2037	2075	4015	4022	4030	4045	4075	4160
Rating	Rated Capacity kW	20	30	50	90	20	30	40	60	100	185
	Rated Output Current (DC) A	60	90	150	280	30	45	60	90	150	280
	Rated Input Current (AC) A	64	96	160	300	32	48	64	96	165	300
	Rated Output Voltage	330 VDC				660 VDC					
Input Power Supply	Voltage Frequency	200 to 220 VAC 50 Hz, 200 to 230VAC 60 Hz				380 to 460VAC 50/60Hz					
	Allowable Voltage Fluctuation	+10% to -15%									
	Allowable Frequency Fluctuation	±3 Hz/300 ms (Free phase rotation)									
Control Characteristics	Control Method	Sine wave PWM method									
	Input Power Factor	0.95 or more (Rated current)									
	Output Voltage Accuracy	±5%									
	Overload Capacity	Stops in 1 minute at approx. 150% of rated current.									
Operation Input		Digital Operator and external terminals									
Status Output	Fault	1N/NC contact output									
	Running	1NO contact output									
	Minor Fault, etc.	Multi-function PHC output: 2 points can be selected.									
	Analog Output	Multi-function analog output: 2 points can be selected.									
Constant Setting		Using the Digital Operator									
Protective Function	Instantaneous Overcurrent	Stops at approx. 200% of the VS-656DC5 input current.									
	Blown Fuse	Motor stops by blown fuse.									
	Overload	Stops after 1 minute at 150% of rated current (power running and regenerating).									
	Undervoltage (Output)	Stops at approx. 190 VDC or less				Stops at approx. 380 VDC or less.					
	Undervoltage (Input)	Stops at approx. 150 VAC or less.				Stops at approx. 300 VAC or less.					
	Overvoltage	Stops at approx. 400 VDC or more.				Stops at approx. 800 VDC or more.					
	Fin Overheat	Protected by thermistor									
	Ground Fault Detection	Protected by electronic circuit*									
	Power Frequency Error	Stops by fluctuation more than ±3 Hz of rated input frequency.									
	Power Charge Indication	Indicated until main circuit output voltage is approx. 50 V or less.									
Environmental Conditions	Location	Indoor (Protected from corrosive gases and dust)									
	Ambient Temperature	-10 °C to +45 °C									
	Humidity	90% RH or less (non-condensing)									
	Vibration	9.8 m/s <sup>2</sup> (1 G) less than 20 Hz, up to 1.96 m/s <sup>2</sup> (0.2 G) at 20 to 50 Hz									

\* A ground fault may not be detected in the following cases.

- If a ground fault with low resistance occurs in cables connected to the Inverter or terminals.
- If a ground fault occurs when the power is turned on

Note: The Varispeed F7 and the Varispeed G7, 200 V class with a 0.4 kW to 75 kW capacity and 400 V class with a 0.4 kW to 160 kW capacity, can be connected to the VS-656DC5.

■ VS-656DC5 Heat Loss (W)

		200 V Class				400 V Class					
Model CIMR-D5A□		2015	2022	2037	2075	4015	4022	4030	4045	4075	4160
Rated Output Capacity kW		20	30	50	90	20	30	40	60	100	185
Rated Output Current A		60	90	150	280	30	45	60	90	150	280
Heat Loss	Cooling Fin Section W	330	550	750	1400	210	340	450	570	1050	2000
	Unit Interior W	170	250	370	700	150	200	250	330	600	1000
	Total Heat Loss W	500	800	1120	2100	360	540	700	900	1650	3000

## Appendix A CONSTANTS LIST

This section describes all the constants that can be monitored in the operation mode, and all the constants that can be used in the initialize mode and programming mode.

The “Access Level” in the table shows in which access level the constant can be changed or monitored. The meaning of each symbol for access level is as follows.

Q	Can display the constant and change the setting by selecting QUICK-START.
B	Can display the constant and change the setting by selecting QUICK-START and BASIC.
A	Can display the constant and change the setting in all the access levels by selecting QUICK-START, BASIC, and ADVANCED.

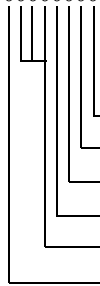
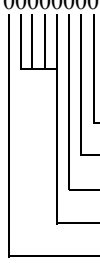
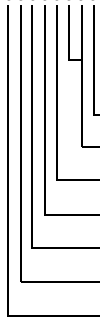
### A.1 Monitor Constant List

The following table shows the constants that can be monitored in the operation mode.

Constant No.	Name [Display]	Unit	Access Level	Remarks
U1-01	Output Voltage Reference (before SFS) [Output V Command]	1 V	Q	• Output signal level at multi-function analog output 200 V class: 10 V : 400 V 400 V class: 10 V : 800 V (0 to +10 V output)
U1-02	Output Voltage Feedback [Output V Feedback]	1 V	Q	• Output signal level at multi-function analog output 200 V class: 10 V : 400 V 400 V class: 10 V : 800 V (0 to +10 V output)
U1-03	Output Current [Output Current]	1 A	Q	• Output signal level at multi-function analog output 10 V: Rated current (0 to +10 V output)
U1-04	Input Voltage [Input Voltage]	1 V	Q	• Output signal level at multi-function analog output 200 V class: 10 V : 200 V 400 V class: 10 V : 400 V (0 to +10 V output)
U1-05	Input Current [Input Current]	1 A	Q	• Output signal level at multi-function analog output 10 V: Rated current (0 to +10 V output)
U1-06	DC Side Power [DC Side Power]	1 kW	Q	• Output signal level at multi-function analog output 10 V: Rated power* (0 to +10 V output)
U1-07	Power Supply Side Power [AC Side Power]	1 kW	Q	• Output signal level at multi-function analog output 10 V: Rated power* (0 to +10 V output)
U1-08	Input Frequency [Input Frequency]	0.01 Hz	Q	• Output signal level at multi-function analog output 10V : Rated power supply frequency If 60 Hz, then 10 V : 60 Hz. If 50 Hz, then 10 V : 50 Hz. (0 to +10 V output)
U1-09	Primary Current [Primary Current]	1 A	Q	• Output signal level at multi-function analog output 10 V: Rated current (0 to +10 V output)

\* The rated power is the maximum applicable output power for the CIMR-D5A□ inverter.

(cont'd)

Constant No.	Name [Display]	Unit	Access Level	Remarks
U1-10	Input Terminal Status [Input Term Sts]	–	Q	Shows input ON/OFF status. = 00000000  <ul style="list-style-type: none"> <li>1: RUN-SB (terminal 1) ON</li> <li>1: STOP (terminal 2) ON</li> <li>1: External fault (terminal 3) ON *1</li> <li>1: Fault reset (terminal 4) ON *1</li> <li>1: Not used (terminals 5 to 7) ON *1</li> <li>1: External baseblock (terminal 8) ON *1</li> </ul> <p>*1: Can be selected by H1-XX. • Output signal level at multi-function analog output: Disabled.</p>
U1-11	Output Terminal Status [Output Term Sts]	–	Q	Shows output ON/OFF status. = 00000000  <ul style="list-style-type: none"> <li>1: Running (terminals 9-10) ON *2</li> <li>1: CREADY (terminals 25 to 27) ON *2</li> <li>1: During MCON (terminals 26-37) ON *2</li> <li>1: Not used (always 0)</li> <li>1: Fault output (terminals 18/19-20) ON</li> </ul> <p>*2: Can be selected by H2-XX. • Output signal level at multi-function analog output: Disabled.</p>
U1-12	Operation Status [Drive Ope Sts]	–	Q	VS-656DC5 operating status = 00000000  <ul style="list-style-type: none"> <li>1: Running</li> <li>1: Not used (always 0)</li> <li>1: Reset input ON</li> <li>1: Not used (always 0)</li> <li>1: VS-656DC5 ready</li> <li>1: Minor fault detected</li> <li>1: Major fault detected</li> </ul> <p>• Output signal level at multi-function analog output: Disabled.</p>
U1-13	Cumulative Operation Time [Elapsed Time]	1 H	Q	• Output signal level at multi-function analog output: Disabled.
U1-14	Software No. [FLASH ID]	–	Q	(Manufacturer's ID number)
U1-17	Input Power Factor [Power Factor]	1%	B	• Output signal level at multi-function analog output 10 V: 100% (0 to +10 V output)
U1-18	Effective Current Reference [Real Current]	0.1%	B	• Output signal level at multi-function analog output 10 V: Rated current (0 to +10 V output)
U1-19	Ineffective Current Reference [Reactive Current]	0.1%	B	• Output signal level at multi-function analog output 10 V: Rated current (0 to +10 V output)

(cont'd)

Constant No.	Name [Display]	Unit	Access Level	Remarks
U1-20	Output Voltage Reference (after SFS) [Output V Com SFS]	1 V	A	• Output signal level at multi-function analog output 200 V class: 10 V : 400 V 400 V class: 10 V : 800 V (0 to +10 V output)
U1-21	AVR Input (Voltage Deviation) [AVR Input]	1 V	A	• Output signal level at multi-function analog output 200 V class: 10 V : 400 V 400 V class: 10 V : 800 V (0 to +10 V output)
U1-22	AVR Output [AVR Output]	1%	A	• Output signal level at multi-function analog output 10 V: 100% (0 to +10 V output)
U1-26	Output Voltage Reference (Vq) [Voltage Ref (Vq)]	1 V	A	• Output signal level at multi-function analog output 10 V: 100% (0 to +10 V output)
U1-27	Output Voltage Reference (Vd) [Voltage Ref (Vd)]	1 V	A	• Output signal level at multi-function analog output 10 V: 100% (0 to +10 V output)
U1-28	Software No. (CPU) [CPU ID]	–	A	• (Manufacturer's ID number)
U1-48	ACRq Output [ACR(q) Output]	0.1%	A	• Output signal level at multi-function analog output 10 V: 100% (0 to +10 V output)
U1-49	ACRd Output [ACR(d) Output]	0.1%	A	• Output signal level at multi-function analog output 10 V: 100% (0 to +10 V output)
U2-01	Current Fault [Current Fault]	–	Q	
U2-02	Last Fault [Last Fault]	–	Q	
U2-03	Output Voltage Reference at Fault (before SFS) [Output V Command]	1 V	Q	
U2-04	DC Bus Voltage at Fault [Output V Feedback]	1 V	Q	
U2-05	Output Current at Fault [Output Current]	1 A	Q	
U2-06	Power Supply Voltage at Fault [Input Voltage]	1 V	Q	
U2-07	Power Side Current at Fault [Input Current]	1 A	Q	
U2-08	Output Power at Fault [DC Side Power]	1 kW	Q	
U2-09	Input Power at Fault [AC Side Power]	1 kW	Q	
U2-10	Input Frequency at Fault [Input Frequency]	0.01 Hz	Q	
U2-11	Primary Current at Fault [Primary Current]	1 A	Q	
U2-12	Input Terminal Status at Fault [Input Term Sts]	–	Q	

(cont'd)

Constant No.	Name [Display]	Unit	Access Level	Remarks
U2-13	Output Terminal Status at Fault [Output Term Sts]	–	Q	
U2-14	Operation Status at Fault [Drive Ope Sts]	–	Q	
U2-15	Cumulative Operation Time at Fault [Elapsed Time]	1H	Q	
U2-16	Input Power Factor at Fault [Power Factor]	1%	B	
U2-17	Effective Current Reference at Fault [Real Current]	0.1%	B	
U2-18	Ineffective Current Reference at Fault [Reactive Current]	0.1%	B	
U2-19	Output Voltage Reference at Fault (after SFS) [Output V Com SFS]	1 V	B	
U2-20	AVR Input at Fault (Voltage Deviation) [AVR Input]	1 V	A	
U2-21	Output Voltage Reference at Fault (Vq) [Voltage Ref (Vq)]	1 V	A	
U2-22	Output Voltage Reference at Fault (Vd) [Voltage Ref (Vd)]	1 V	A	
U3-01	Most Recent Fault [Last Fault]	–	Q	
U3-02	Second Most Recent Fault [Fault Message 2]	–	Q	
U3-03	Third Most Recent Fault [Fault Message 3]	–	Q	
U3-04	Fourth/oldest Fault [Fault Message 4]	–	Q	
U3-05	Cumulative Operation Time at Fault [Elapsed Time 1]	1H	Q	
U3-06	Accumulated Time of Second Fault [Elapsed Time 2]	1H	Q	
U3-07	Accumulated Time of Third Fault [Elapsed Time 3]	1H	Q	
U3-08	Accumulated Time of Fourth/oldest Fault [Elapsed Time 4]	1H	Q	

## A.2 Constant List Other Than Monitor Constants

Constant No.	Name [Display]	Initial Value	Setting Range	Change during Operation	Access Level	Remarks
A1-00	Language selection for Digital Operator display [Select Language]	1	0, 1	Possible	Q	0: English 1: Japanese
A1-01	Constant access level [Access Level]	2	0 to 9999	Possible	Q	0: Monitoring only 2: Quick-start (Q) 3: Basic (B) 4: Advanced (A)
A1-03	Initialize [Init Parameters]	0000	0000 to 9999	–	Q	2220: Initializes using the User Constants.
A1-04	Password 1 (Input) [Enter Password]	0	0000 to 9999	–	Q	
A1-05	Password 2 (Setting) [Select Password]	0	0000 to 9999	–	–	
B1-01	Voltage Reference Method Selection [Reference Source]	0	0 1 cannot be set.	–	Q	0: Digital Operator
B1-02	Operation Method Selection [Run Source]	1	0, 1	–	Q	0: Digital Operator 1: Control circuit terminals
B1-04	PRG Mode Run Command Selection [RUN CMD at PRG]	0	0, 1	–	A	0: Disabled 1: Enabled
B1-06	Read Sequence Input Twice [Cntl Input Scans]	1	0, 1	–	A	0: Two scans every 3 msec 1: Two scans every 5 msec
C1-01	Acceleration Time [Accel Time]	10.0	0.0 to 6000.0 s	Possible	Q	
C1-02	Deceleration Time [Decel Time]	10.0	0.0 to 6000.0 s	Possible	Q	
C5-01	AVR Proportional (P) Gain [AVR P Gain]	20.00	1.00 to 300.00	Possible	B	
C5-02	AVR Integral (I) Time [AVR I Time]	0.500	0.000 to 10.000 sec	Possible	B	
D1-01	Voltage Reference [Voltage Command]	Refer to <i>Remarks.</i>	300 to 340 V (200 V class) 600 to 680 V (400 V class)	Possible	Q	330 (200 V class), 660 (400 V class)
F1-10	Excessive Frequency Deviation Detection Level [FDEV Detect Level]	3.0	1.0 to 10.0 Hz	–	A	
F1-11	Excessive Frequency Deviation Detection Delay Time [FDEV Detect Time]	70.0	0.0 to 255.0 ms	–	A	
H1-01	Multi-function Input (Terminal 3) [Terminal 3 Sel]	24	00 to FF	–	B	24: External Fault See page E-47.
H1-02	Multi-function Input (Terminal 4) [Terminal 4 Sel]	14	00 to FF	–	B	14: Fault reset See page E-47.
H1-03	Multi-function Input (Terminal 5) [Terminal 5 Sel]	0F	00 to FF	–	B	0F: Not used See page E-47.



(cont'd)

Constant No.	Name [Display]	Initial Value	Setting Range	Change during Operation	Access Level	Remarks
H1-04	Multi-function Input (Terminal 6) [Terminal 6 Sel]	0F	00 to FF	–	B	0F: Not used See page E-47.
H1-05	Multi-function Input (Terminal 7) [Terminal 7 Sel]	0F	00 to FF	–	B	0F: Not used See page E-47.
H1-06	Multi-function Input (Terminal 8) [Terminal 8 Sel]	08	00 to FF	–	B	08: External baseblock See page E-47.
H2-01	Multi-function Output (Terminal 9-10) [Terminal 9 Sel]	00	00 to FF	–	B	00: During running
H2-02	Multi-function Output (Terminal 25) [Terminal 25 Sel]	06	00 to FF	–	B	06: Converter ready
H2-03	Multi-function Output (Terminal 26) [Terminal 26 Sel]	0A	00 to FF	–	B	0A: During MCON
H4-01	Multi-function Monitor AO (terminal 21) [Terminal 21 Sel]	07	0 to 50	Possible	B	07: Power at power supply side
H4-02	Gain (Terminal 21) [Terminal 21 Gain]	1.00	-99.99 to 99.99	Possible	B	
H4-03	Bias (Terminal 21) [Terminal 21 Bias]	0	-9999 to 9999	Possible	B	
H4-04	Multi-function Monitor AO (Terminal 23) [Terminal 23 Sel]	05	0 to 50	Possible	B	05: Current at power supply side
H4-05	Gain (Terminal 23) [Terminal 23 Gain]	1.00	-99.99 to 99.99	Possible	B	
H4-06	Bias (Terminal 23) [Terminal 23 Bias]	0	-9999 to 9999	Possible	B	
H4-07	Analog Output Signal Polarity Selection [AO Level Select]	1	0, 1	–	B	0: Without sign 1: With sign
L2-01	Momentary Power Loss Detection [PwrL Selection]	0	0 to 2	–	B	0: Fault 1: Operation continues within power loss ride through time 2: Operation continues if control power supply is hold. Note: Even if L2-01 is set to 1 or 2, the VS-656DC5 may detect a fault if momentary power loss occurs during regeneration.
L2-02	Momentary Power Loss Ridethru Time [PwrL Ridethru t]	1.0	0.0 to 2.0 s	–	B	
L2-05	Undervoltage Detection Level [PUV Det Level]	190	150 to 210 V	Possible	A	For 400 V class, double the setting.
L3-04	Operation Selection at Input OL (OL1) Operation [OL1 Det Sel]	1	0, 1	–	B	0: Continues operation. 1: Stops operation.

(cont'd)

Constant No.	Name [Display]	Initial Value	Setting Range	Change during Operation	Access Level	Remarks
L5-01	Number of auto restart attempts [Num of Restarts]	0	0 to 10	–	B	
L5-02	Auto Restart Operation Selection [Restart Sel]	0	0, 1	–	B	0: Not output (Fault contact is not activated.) 1: Output (Fault contact is activated.)
L8-02	VS-656DC5 Overheat Pre-alarm Level [OH Pre-Alarm Lvl]	95	50 to 110 deg	–	A	
L8-03	VS-656DC5 Operation Selection after Overheat Pre-alarm [OH Pre-Alarm Sel]	3	1, 3	–	A	1: Stops operation. 3: Continues operation.
L8-10	Ground Protection Selection [Ground Fault Sel]	1	0, 1	–	A	0: Ground protection enabled 1: Ground protection disabled
O1-01	Monitor Selection [User Monitor Sel]	8	4 to 50	Possible	B	
O1-02	Monitor Selection after Power Up [Power-On Monitor]	1	1 to 4	Possible	B	1: Output voltage reference (U1-01) 2: Output voltage feedback (U1-02) 3: Output current (U1-03) 4: The monitor item set for O1-01
O2-01	LOCAL/REMOTE Key Enable/Disable [Local/Remote Key]	1	0, 1	–	B	0: Disabled 1: Enabled
O2-02	STOP Key during Remote Operation [Oper STOP Key]	0	0, 1	–	B	0: Enabled during run command from the Digital Operator 1: Enabled
O2-04	Converter kVA Selection [Converter Model]	*	00 to FF	–	B	*: Varies depending on VS-656DC5 capacity.
O2-06	Operation Selection when Digital Operator is Disconnected [Oper Detection]	0	0, 1	–	A	0: Operation continues even if the Digital Operator is disconnected. 1: VS-656DC5 fault is detected at Digital Operator disconnection.
O2-07	Cumulative Operation Time Setting [Elapsed Time Set]	–	0 to 65535H	–	A	
O2-08	Cumulative Operation Time Selection [Elapsed Time Run]	0	0, 1	–	A	0: Cumulative time when the VS-656DC5 is on. 1: Cumulative VS-656DC5 run time.

\* Do not change the initial value, as it was appropriately set at the factory.

If using a control board with a different capacity, confirm that O2-04 is set to the correct value for the capacity of the converter to be used (see the following table). If O2-04 is not set correctly, operation may become unstable or the VS-656DC5 may be damaged.

Constant No.	Name	Unit	Factory Setting									
			2015	2022	2037	2075	4015	4022	4030	4045	4075	4160
–	Converter Capacity	kW	2015	2022	2037	2075	4015	4022	4030	4045	4075	4160
O2-04	Converter kVA Selection	–	8	A	C	F	29	2B	2C	2E	30	34

## A.3 Multi-function I/O Terminals (H Constants)

Table 14 Multi-function Input Functions

Setting Value	Function (H1-01, 02, 03, 04, 05, 06)	Remarks
08	External Baseblock (NO Contact) [Ext BaseBlk N.O.]	
09	External Baseblock (NC Contact) [Ext BaseBlk N.C.]	
0F	Not Used [Term Not Used]	
14	Fault Reset [Fault Reset]	
24-27	External fault [External Fault]	
2C-2F		

Table 15 Multi-function Output Functions

Setting Value	Function (H2-01, 02, 03)	Remarks
00	During Run [During Run]	
01	Inverter Ready [Inverter Ready]	
06	Converter Unit Ready [Converter Ready]	
07	During DC Bus Undervoltage (UV) Detection [DC Bus Undervolt]	
08	During Baseblock [BaseBlock]	
0A	During MCON [MCON]	
0E	Fault [Fault]	
0F	Not used [Not Used]	
10	Alarm [Minor Fault]	
11	Fault Reset Command Active [Reset Cmd Active]	
1D	Motoring/regenerating [Regenerating]	
1E	Restart Enabled [Restart Enabled]	
1F	Overload (OL1) Pre-alarm [Overload (OL1)]	
20	Overheat pre-alarm [OH Prealarm]	

## Appendix B PRECAUTIONS ON VS-656DC5 APPLICATION

### ■ VS-656DC5 Capacity Selection

Select the largest capacity from  $P_1$ ,  $P_2$ , and  $P_3$  or larger value for the rated output capacity of the VS-656DC5 ( $P_{out}$ ).

1.  $P_1$  (kW) : Motoring side capacity minus regenerating capacity.

$$P_1 \text{ (kW)} = \underbrace{\frac{1}{\eta_{INV} \times \eta_M} (P_{M1} + \dots + P_{MN})}_{\text{Motoring Side Capacity}} - \underbrace{\eta_{INV} \times \eta_M (P_{M1}' + \dots + P_{MN}')}_{\text{Regenerating Side Capacity}}$$

$P_{out}$ : VS-656DC5 rated output HP (kW)

$P_{M1}$  to  $P_{MN}$ : Motor output HP (kW)

$\eta_M$ : Motor efficiency 0.9\*

$\eta_{INV}$ : Inverter efficiency 0.95\*

\* When a motor less than 10HP (7.5 kW) is used, set the motor efficiency and inverter efficiency to 0.85 and 0.9, respectively.

Note: When the imbalance ratio between the phases exceeds 2%, use the VS-656DC5 of one frame larger.

The imbalance ratio between the phases can be calculated as follows:

$$\text{Imbalance ratio between phases [\%]} = \frac{\text{Max.voltage} - \text{Min.voltage}}{\text{3-phase average voltage}} \times 67$$

2.  $P_2$  (kW) : The largest capacity of the Inverters connected to the VS-656DC5.

3.  $P_3$  (kW) : One third of the total capacity of Inverters connected to the VS-656DC5.

### ■ Input AC Reactor

Input AC reactors each of which corresponds to each capacity of the VS-656DC5, (considering saturation current and thermal items) are necessary for the PWM converter VS-656DC5.

Use the proper reactors for applications.

### ■ VS-656DC5 Power off and Harmonics Filter

Set up sequence that opens after the VS-656DC5 operation is stopped at the VS-656DC5 power supply side. Be sure to attach the specified harmonics filter to reduce the influence on other devices caused by surge voltage at open that unexpectedly occurs during run.

### ■ Installation on the VS-656DC5 Output (DC) Side

If installing a circuit breaker or a magnetic contactor on the VS-656DC5 output (DC) side to shut down the power supply in an emergency, observe the following precautions.

- Be sure to confirm that the charge lamps on the VS-656DC5 and the Inverter are not lit, and then turn on the circuit breaker or contactor.

If the circuit breaker or contactor is turned on while power is supplied to the VS-656DC5 and the Inverter, an overcurrent may occur and damage the circuit breaker or contactor.

- Be sure to confirm that the circuit breaker or contactor is turned on before the power is turned on for the VS-656DC5.

## ■ Power Supply Capacity Selection

Regardless of the size of the connected load, use a power supply with a capacity larger than the VS-656DC5 rated input capacity (See the following formula). If a power supply with a capacity smaller than the VS-656DC5 rated input capacity is used, an operation error may occur or the VS-656DC5 may be damaged. When selecting a power supply, contact your Yaskawa representative.

Use the following formula to obtain the VS-656DC5 rated input capacity.

$$S_{\text{conv}} = \sqrt{3} \times I_{\text{AC\_rate}} \times V_{\text{in}} \div 1000$$

[ $I_{\text{AC\_rate}}$ : VS-656DC5 rated input current (A),  $V_{\text{in}}$ : Power supply line voltage (V)]

## ■ Interlocking with Inverters

It is necessary to interlock between the VS-656DC5 and the Inverter to stop the Inverter by using the VS-656DC5 fault signal. To restart the operation after a momentary power loss at the Inverter side, the timing for reactivation must be assured.

The “MC Operating (MCON)” signal that the VS-656DC5 outputs from the control terminal is used to assure the timing. When the “MC Operating (MCON)” signal is “open,” use the Inverter external baseblock input to make a sequence to shut off the Inverter output.

[Case 1] When reactivation after momentary power loss is not performed (Coasting to a stop by momentary power loss detection)

Assign the “MC Operating (MCON)” output of the VS-656DC5 to the Inverter “External Fault” input.

The input for the Inverter “External Fault” is set to NC contact. To prevent external fault operation at power supply on, select “External fault accepted only during RUN.”

[Case 2] When reactivation after momentary power loss is performed as system

- For Varispeed F7 and Varispeed G7

Assign the “During MC motion” output of the VS-656DC5 to the Inverter “External baseblock” input.

Reactivate the Inverter after momentary power loss. Select the setting for NC contact input for the Inverter “External baseblock” input.

- For all other Inverters

Assign the “During MC motion” output of the VS-656DC5 to the Inverter “External search command 3” input. If using Inverters without an “External search command 3”, contact your Yaskawa representative for details.

## ■ Precautions on Application of Peripheral Devices

When a noise filter is attached on the VS-656DC5 power supply side, use a noise filter of the reactor type (without a capacitor) such as fine met zero-phase reactor, and attach it behind the MCCB at the power supply side. Do not use a capacitor-built-in type noise filter since the harmonic components may overheat or damage the capacitor.

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## ■ When the Power Supply is a Generator

- Select the generator capacity approx. twice as large as the VS-656DC5 input power supply capacity. (For further information, contact your YASKAWA representative.)
- Set such deceleration time or load so that the regenerative power from the motor will be 10% or less of the generator capacity.

## ■ When A Phase Advance Capacitor or Thyristor Controller Is Provided for the Power Supply

No phase advance capacitor is needed for the VS-656DC5. Installing one on the VS-656DC5 will result in reduction of power factor.

For the phase advance capacitor that has already been installed on the same power supply system as the VS-656DC5, attach a series reactor to prevent oscillation with the VS-656DC5.

Contact your YASKAWA representative, if any derive generating voltage surge or voltage distortion such as DC motor drive thyristor controller or magnetic agitator is installed on the same power supply system.

## ■ Prevention from EMC (Radio Noise) or Harmonics Leak Current

No preventive action from harmonics current is needed. However, some preventive actions from EMC (radio noise) or harmonics leak current are necessary as well as the general inverter drives.

If any device that is apt to be affected by noise is near the VS-656DC5, use a noise filter of the above-mentioned reactor type (zero-phase reactor).

Use a leakage relay or an earth leakage breaker designed for Inverters (products provided with prevention from harmonics leak current), when necessary.

## ■ Guideline for Harmonics Reduction

The guideline for harmonics is available for users who receive 6.6 kV or more from the power supply system.

## ■ Influence by Power Supply Distortion

When the power supply voltage is distorted, or when several devices are connected in parallel to the same power supply, the harmonics contents become larger since the harmonics of the power supply system enter the VS-656DC5.

# VARISPEED-656DC5 INSTRUCTION MANUAL

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