Parallel Connection Control Application Manual

Applicable Products:

C2000 Plus / C2000-HS / C2000-R

http://www.deltaww.com/

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(Translation of the original instructions)

PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.

DANGER

- ☑ Disconnect AC input power before connecting any wiring to the AC motor drive.
- ☑ When wiring, turn off the AC motor drive power first. It takes a certain time for the internal DC capacitor to discharge. A charge may still remain in the DC link capacitors with hazardous voltages before the POWER LED is OFF. Do NOT touch the internal circuits and components. To avoid damage, use a voltmeter for testing. Wiring only after the voltage is lower than the safety voltage value of 25 V_{DC}. If the AC motor drive does not fully discharge, there will be residual voltage inside. Any wiring at this time causes short-circuit and fire. It is strongly suggested to operate the wiring under no-voltage conditions to ensure personnel safety.
- ☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Take anti-static measure before touching these components or the circuit boards.
- ☑ Never modify the internal components or wiring.
- ☑ Ground the AC motor drive by using the ground terminal. The grounding method must comply with the laws of the country where the AC motor drive is to be installed.
- ☑ Do NOT install the AC motor drive in a location with high temperature, direct sunlight or inflammable materials or gases.

CAUTION

- ☑ Never connect the AC motor drive output terminals U/T1, V/T2 and W/T3 directly to the AC mains circuit power supply.
- ☑ After finishing the wiring of the AC motor drive, check if R/L1, S/L2, and T/L3 are short-circuited to ground with a multimeter. Do NOT power the drive if short circuits occur. Eliminate the short circuits before the drive is powered.
- ☑ The rated voltage of power system to install motor drives is listed below. Ensure that the installation voltage is in the correct range when installing a motor drive.
  1. For 230V models, the range is between 170–264V.
  2. For 460V models, the range is between 323–528V.
  3. For 575V models, the range is between 446–660V.
  4. For 690V models, the range is between 446–759V.
- ☑ Refer to the table below for short circuit rating:

Model (Power)	Short circuit rating
230V / 460V	100 kA
575V (2–20HP)	5 kA
690V (25–50HP)	5 kA
690V (60–175HP)	10 kA
690V (215–335HP)	18 kA
690V (425–600HP)	30 kA
690V (745–850HP)	42 kA

- ☑ Only qualified persons are allowed to install, wire, and maintain the AC motor drives.
- ☑ Even if the three-phase AC motor is stopped, a charge with hazardous voltages may still remain in the main circuit terminals of the AC motor drive.

	☑ The performance of electrolytic capacitor will degrade if it is not charged for a long time. It is recommended to charge the drive which is stored in no charge condition every 2 years for 3–4 hours to restore the performance of electrolytic capacitor in the motor drive. Note: When power up the motor drive, use adjustable AC power source (ex. AC autotransformer) to charge the drive at 70–80% of rated voltage for 30 minutes (do not run the motor drive). Then charge the drive at 100% of rated voltage for an hour (do not run the motor drive). By doing these, restore the performance of electrolytic capacitor before starting to run the motor drive. Do NOT run the motor drive at 100% rated voltage right away. ☑ Pay attention to the following precautions when transporting and installing this package (including wooden crate and wood stave) 1. If you need to deworm the wooden crate, do NOT use fumigation or you will damage the drive. Any damage to the drive caused by using fumigation voids the warranty. 2. Use other methods, such as heat treatment or any other non-fumigation treatment, to deworm the wood packaging material. 3. If you use heat treatment to deworm, leave the packaging materials in an environment of over 56°C for a minimum of thirty minutes. ☑ Connect the drive to a three-phase three-wire or three-phase four-wire Wye system to comply with UL standards. ☑ If the motor drive generates leakage current over AC 3.5 mA or over DC 10 mA on a grounding conductor, compliance with local grounding regulations or IEC61800-5-1 standard is the minimum requirement for grounding.

NOTE: The content of this manual may be revised without prior notice. Please consult our distributors or download the latest version at http://www.deltaww.com/iadownload_acmotordrive

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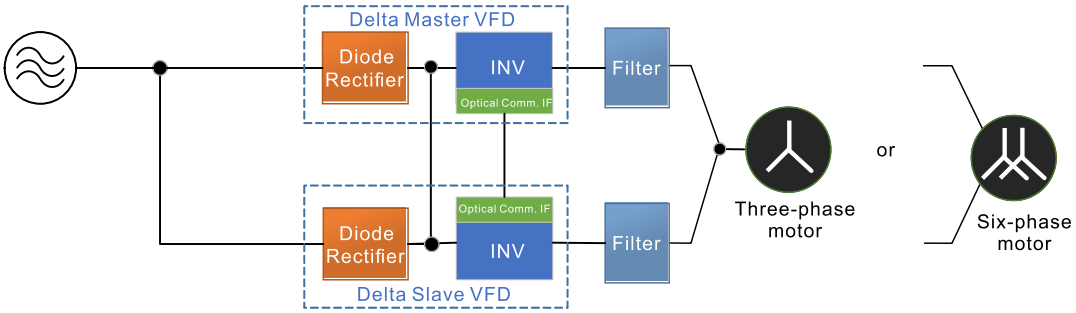
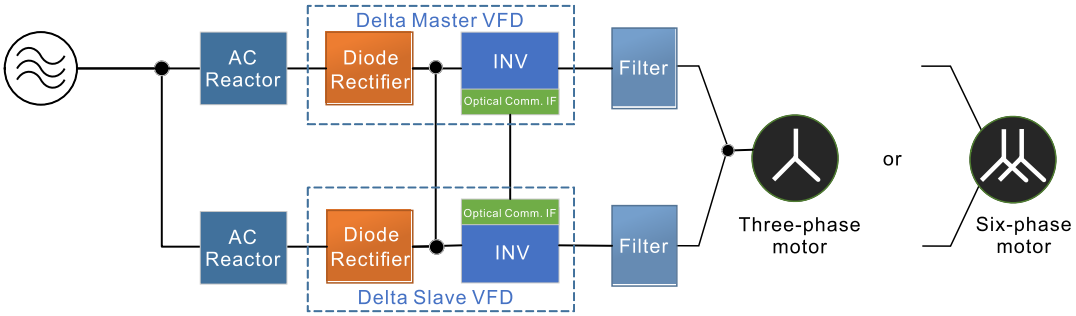
Chapter 1 System Architecture Overview

1-1 Overview of Parallel Control

The parallel solution model is suitable for AC motor drives with the same power of 220kW and above (C2000 Plus, C2000-HS and C2000-R). It addresses the need for capacity expansion in high-power control by enabling internal communication between two AC motor drives (master/ slave) for parallel expansion control. This solution integrates optical fiber communication and system codes to ensure effective parallel control.

In parallel application, due to communication limits, the carrier wave can only reach up to 6 kHz, and the current specification should take 8% derating coefficient (multiplied by 0.92) into consideration when selecting AC motor drive models.

Delta's high-power frequency conversion solutions are divided into two categories:

Solution	Description
Non-common DC bus	● Considers 8% derating coefficient (multiplied by 0.92) when selecting AC motor drives. ● The length of the powering wire from the mains power supply to the drive must be consistent. 
Common DC bus	● Due to the different input impedance, circulating current will be generated between some drives. It is necessary to install an AC reactor on the power input side to achieve the effect of proper current distribution. ● Install each drive as close to each other as possible to reduce the wire length and to reduce the DC side wire inductance as much as possible. ● When installing with common DC bus, it is recommended to install a fuse on the DC side. 

NOTE:

- Ensure that the two parallel-connected drives are **the same series models** with **the same power**.
- The six-phase motor does not require the output reactors.

1-2 Model List

Non-common DC bus parallel connection application selection

AC Motor Drive				Reactor	
Power (kW)	Applicable AC Motor Drive Models	Rated Current* (A)	Qty	Applicable Reactor Selection	Inductance Value (μH)
405	VFD2200C43x	846	2	DR505LP004P	4.35
	VFD2200C43x-HS	846	2	DR505LP004P	4.35
	VFD2200C43A-00R	846	2	DR505LP004P	4.35
460	VFD2500C43x	885	2	DR505LP004P	4.35
	VFD2500C43A-00R	929	2	DR505LP004P	4.35
515	VFD2800C43x	1012	2	DR616LP004P	3.77
	VFD2800C43A-00R	1012	2	DR616LP004P	3.77
580	VFD3150C43x	1133	2	DR616LP004P	3.77
	VFD3150C43A-00R	1133	2	DR616LP004P	3.77
653	VFD3550C43x	1256	2	DR770LP003P	2.93
	VFD3550C43x-HS	1256	2	DR770LP003P	2.93
	VFD3550C43A-00R	1288	2	DR770LP003P	2.93
736	VFD4000C43x	1416	2	DR770LP003P	2.93
828	VFD4500C43x	1593	2	DR930LP002P	2.41
	VFD4500C43A-00R	1527	2	DR930LP002P	2.41
920	VFD5000C43x	1711	2	DR930LP002P	2.41
1030	VFD5600C43x	2012	2	DR1212LP002P	1.82

NOTE: *The rated current is based on the default load mode rated current of each model. Table 1-1

Common DC bus parallel connection application selection

AC Motor Drive				Reactor	
Power (kW)	Applicable AC Motor Drive Models	Rated Current* (A)	Qty	Applicable Reactor Selection	Inductance Value (μH)
440	VFD2200C43x	920	2	DR505LP004P	4.35
	VFD2200C43x-HS	920	2	DR505LP004P	4.35
	VFD2200C43A-00R	920	2	DR505LP004P	4.35
500	VFD2500C43x	962	2	DR505LP004P	4.35
	VFD2500C43A-00R	1010	2	DR505LP004P	4.35
560	VFD2800C43x	1100	2	DR616LP004P	3.77
	VFD2800C43A-00R	1100	2	DR616LP004P	3.77
630	VFD3150C43x	1232	2	DR616LP004P	3.77
	VFD3150C43A-00R	1232	2	DR616LP004P	3.77
710	VFD3550C43x	1366	2	DR770LP003P	2.93
	VFD3550C43x-HS	1366	2	DR770LP003P	2.93
	VFD3550C43A-00R	1400	2	DR770LP003P	2.93
800	VFD4000C43x	1540	2	DR770LP003P	2.93
900	VFD4500C43x	1732	2	DR930LP002P	2.41
	VFD4500C43A-00R	1660	2	DR930LP002P	2.41
1000	VFD5000C43x	1860	2	DR930LP002P	2.41
1120	VFD5600C43x	2188	2	DR1212LP002P	1.82

NOTE: *The rated current is based on the default load mode rated current of each model. Table 1-2

C2000 Plus

Frame			G		H						
VFD-_ _ _ C_ _ _-21 / -00			2200	2500	2800	3150	3550	4000	4500	5000	5600
*Output Rating	Heavy Duty	Rated Output Capacity (kVA)	367	383	438	491	544	613	690	741	872
		Rated Output Current (A)	460	481	550	616	683	770	866	930	1094
		Applicable Motor Output (kW)	220	250	280	315	355	400	450	500	560
		Applicable Motor Output (HP)	300	340	375	420	475	530	600	675	750
		Overload Capacity	150% of rated output current: 1 minute for every 5 minutes; 180% of rated output current: 3 seconds for every 30 seconds								
		Max. Output Frequency (Hz)	0.00–599.00								
		Carrier Frequency (kHz)	2–9 (Default: 4)								
	Super Heavy Duty	Rated Output Capacity (kVA)	295	315	366	438	491	544	544	690	741
		Rated Output Current (A)	370	395	460	550	616	683	683	866	930
		Applicable Motor Output (kW)	185	200	220	280	315	355	355	450	500
		Applicable Motor Output(HP)	250	270	300	375	425	475	475	600	675
		Overload Capacity	150% of rated output current: 1 minute for every 5 minutes; 200% of rated output current: 3 seconds for every 30 seconds								
		Max. Output Frequency (Hz)	0.00–599.00								
		Carrier Frequency (kHz)	2–9 (Default: 4)		2–9 (Default: 3)						
Input Rating	Input Current (A)	Heavy Duty	400	447	494	555	625	770	866	930	1094
		Super Heavy Duty	380	390	400	494	555	590	625	866	930
	Rated Voltage / Frequency		3-phase AC 380V–480V (-15 % – +10 %), 50 / 60 Hz								
	Operating Voltage Range		323–528 V_{AC}								
	Frequency Tolerance		47–63 Hz								
	Power Supply Capacity (kVA)	Heavy Duty	332.5	371.6	410.7	461.4	519.6	640.1	720.0	773.2	909.5
		Super Heavy Duty	315.9	324.2	332.5	410.7	461.4	490.5	519.6	720.0	773.2
Efficiency (%)			98.2								
Displacement Power Factor (cosθ)			>0.98								
Drive Weight (kg)			134 ± 4		228						
Cooling Method			Fan Cooling								
Braking Chopper			Optional								
DC choke			Built-in								
EMC Filter			Optional								
EMC-COP01			Frame G–H (VFDxxxC43A-00): Optional Frame G–H (VFDxxxC43A-21): Built-in								

Table 1-3

NOTE:

1. * : The default setting is heavy duty mode.
2. The carrier frequency is default. Increasing the carrier frequency requires a reduction in current. Refer to Section 9-7 Derating Curve for details in C2000 Plus User Manual.
3. The AC motor drive should operate in derating current when its control method is set to FOC Sensorless, TQC+PG, TQC sensorless, PM+PG or PM sensorless. Refer to description of Pr.06-55 in C2000 Plus User Manual for more information.
4. The rated input current will be affected by not only power transformer and the connection of the reactors on the input side, but also fluctuates with the impedance of power side.
5. Model VFD4500C43x-xx, VFD5000C43x-xx and VFD5600C43x-xx do not have UL certification.
6. Rated output capacity is calculated by 460 V_{AC}, it is as a reference for the mains power drive capacity selection.

C2000-HS

Frame				G	H
VFD-_ _ _ C43x-HS				2200	3550
Output Rating	Normal Duty	Rated Output Capacity (kVA)		367	544
		Rated Output Current (A)		460	683
		Applicable Motor Output (kW)		220	355
		Applicable Motor Output (HP)		300	475
		Overload Capacity		120% of rated output current: 1 minute for every 5 minutes; 160% of rated output current: 3 seconds for every 30 seconds	
		Max. Output Frequency (Hz)	IM	1000	900
			PM	1000	900
		Carrier Frequency (kHz)		2–9 (Default: 6)	
Input		Input Current (A)		400	625
		Rated Voltage / Frequency		3 phase 380–480 V_{AC} (-15 – +10%), 50 / 60 Hz	
		Operating Voltage Range		323–528 V_{AC}	
		Frequency Tolerance		47–63 Hz	
Efficiency (%)				> 98	> 98
Displacement Power Factor (cosθ)				> 0.98	
Drive Weight (kg)				138	228
Cooling Method				Fan Cooling	
Braking Chopper				Optional	
DC choke				Built-in, EN61000-3-12	
EMC Filter				Frame D0–H: Optional	

Table 1-4

NOTE:

1. The carrier frequency is default. Increasing the carrier frequency requires a reduction in current. Refer to Section 9-4 Derating Curve in C2000-HS User Manual.
2. Select the AC motor drive with capacity one grade larger for the impact load application.
3. The rated input current will be affected by not only Power Transformer and the connection of the reactors on input side, but also fluctuates with the impedance of power side.
4. For Frame D0 and above, if the last character of the model is A then it is under IP20 protection level, but the wiring terminal is under IP00 protection level.

C2000-R

Frame			G		H			
VFD_ _ _ _ C43A-00R			2200	2500	2800	3150	3550	4500
Output Rating	Light Duty	Rated Output Capacity (kVA)	367	402	438	491	544	660
		Rated Output Current (A)	460	505	550	616	700	830
		Applicable Motor Output (kW)	220	250	280	315	355	450
		Applicable Motor Output (HP)	300	340	375	420	475	600
		Overload Capacity	120% of rated output current: 1 minute for every 5 minutes					
		Max. Output Frequency (Hz)	0.00–599.00					
		Carrier Frequency (kHz)	2–8 (Default: 4)					
	Heavy Duty	Rated Output Capacity (kVA)	247	270	295	367	383	500
		Rated Output Current (A)	310	340	370	460	505	630
		Applicable Motor Output (kW)	160	170	185	220	250	315
		Applicable Motor Output (HP)	215	230	250	300	340	420
		Overload Capacity	1.0 Hz Operation 80% of rated output current: continuous operation 150% of rated output current: 5 seconds for every 10 minutes 2.1 Hz to Max. Operation Frequency 150% of rated output current: 1 minute for every 5 minutes 180% of rated output current: 3 sec. for every 30 seconds					
		Max. Output Frequency (Hz)	0.00–599.00					
		Carrier Frequency (kHz)	2–8 (Default: 2)					
Input Rating	Input Current (A)	Light Duty	425	465	510	570	645	765
		Heavy Duty	300	370	380	400	481	590
	Rated Voltage / Frequency		3-phase AC 380–480V (-15 – +10%), 50 / 60 Hz					
	Operating Voltage Range		323–528 V_{AC}					
	Frequency Tolerance		47–63 Hz					
Efficiency (%)			97.2	97.2	97.6	97.6	97.6	97.6
Displacement Power Factor (cosθ)			>0.98					
Drive Weight (kg)			105 ±4 kg		151 ±5 kg	154 ±5 kg	157 ±5 kg	167 ±7 kg
Cooling Method			Water Cooling					
Braking Chopper			Optional					
DC choke			Built-in					
12 Pulse Input			Available for Frame H					

Table 2-1 Table 1-5

NOTE:

1. The carrier frequency is default. Increasing the carrier frequency requires a reduction in current. Refer to Section 9-4 Derating Curve in C2000-R User Manual.
2. The AC motor drive should operate in derating current when its control method is set to FOC Sensorless, TQC+PG, TQC sensorless. PM+PG or PM sensorless. Refer to Pr.06-55 for more information.
3. Select the AC motor drive with capacity one grade larger for the impact load application.
4. The rated input current will be affected by not only power transformer and the connection of the reactors on input side, but also fluctuates with the impedance of power side.

1-3 Accessories Overview

1-3-1 CMC-FB01 -- Fiber Communication Card

When the AC motor drive is used in parallel control, the master and slave drive communicate with each other through optical fiber. This communication relies on the SPI interface between the MCU and the FPGA optical fiber card. The transmission and reception of signals are completed during each PWM cycle.

Figure 1-1

- In C2000 series, the optical fiber communication card is installed in Slot 2 by default. If you need to install the communication card in Slot 1, contact Delta for further information.
- Delta provides two length options for the required fiber optic communication cables.

Model Name	Description	Fiber Optic Cable Part Number
CBC-FB3M	CABLE FOR CMC-FB01 – 3M	3080669500
CBC-FB5M	CABLE FOR CMC-FB01 – 5M	3080594300

Table 1-6

- In the diagram on the left:
  - The left upper corner and the right lower corner are the screw fixing holes.
  - The connector on the bottom of the board are fiber optical communication cables, the black one is RX, and the gray one is TX.

Communication Specifications

	Item	
	Internal Communication (MCU and FPGA)	External Communication (between master and slave FPGAs)
Transmission Method	SPI synchronous serial (half-duplex)	UART asynchronous serial (full duplex)
Error Checking Method	CRC and timeout monitoring	CRC and timeout monitoring

Table 1-7

Light Meanings

Item	SDP3	SDP4	SDP5	SDP6
Light Colors	Green	Green	Green	Red
Blinking / Steady	Steady	Blinking	Steady	Steady
Representation	MCU and FPGA Communication	FPGA Power	Fiber Card Communication	Configuration Data
Description	If the green light is ON, communication is normal. If it is OFF, check the SPI pins for connection issues or configuration problems.	If the green light flashes, the fiber optic card is powered on. If it does not light up, check for poor contact at the power PIN.	If the green light is ON, the fiber optic cards are communicating normally. If it is OFF, the communication between the cards has not been established. Check whether the fiber cables are damaged.	If there is an error in the optical fiber communication, the red light will be ON.

Table 1-8

1-3-2 Reactor

During the parallel control, if there is no reactor installed on the output side, some of the current from the drive flows into the parallel drive and causes circulating current. Install an output reactor can prevent the above circulating current occurs. Refer to the user manual of each drive models in Delta Download Center for reactor selections.

- C2000 Plus User Manual (refer to Section 7-4)
  https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=22212&DocPath=1&hl=en-US
- C2000-HS User Manual (refer to Section 7-4)
  https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=42836&DocPath=1&hl=en-US
- C2000-R User Manual (refer to Section 7-3)
  https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=44189&DocPath=1&hl=en-US

Parallel circulating current reactor

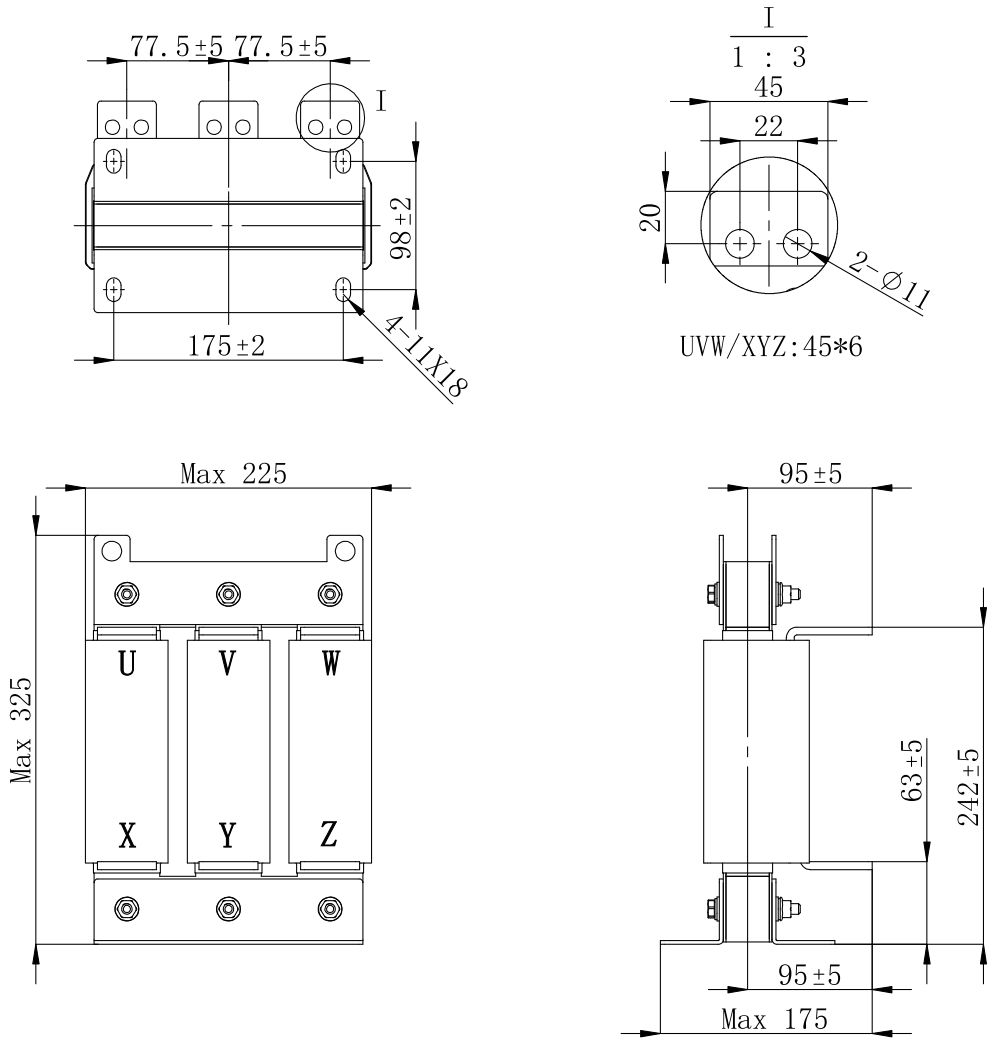


Figure 1-2

Parallel Circulating Current Reactor Delta #	kW	Rated Current (A)	Inductance Value (μH)	Saturated Current (Arms)	Consumption (W)	Dimension (mm)	UL Certification
DR505LP004P	220	505	4.35	757.5	96.2	As shown in the figure above	Pass
	250						

Table 1-9

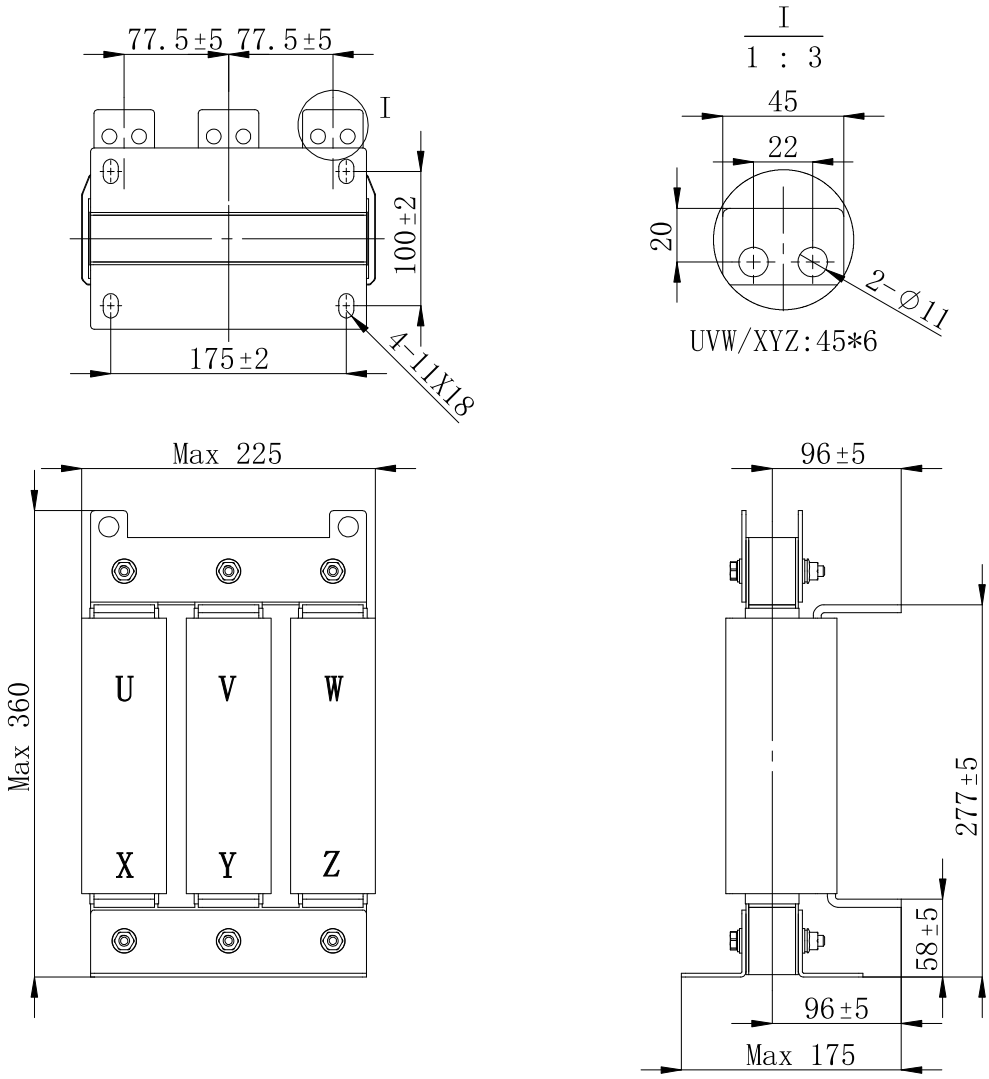


Figure 1-3

Parallel Circulating Current Reactor Delta #	kW	Rated Current (A)	Inductance Value (μH)	Saturated Current (Arms)	Consumption (W)	Dimension (mm)	UL Certification
DR616LP004P	280	616	3.77	924	124	As shown in the figure above	Pass
	315						

Table 1-10

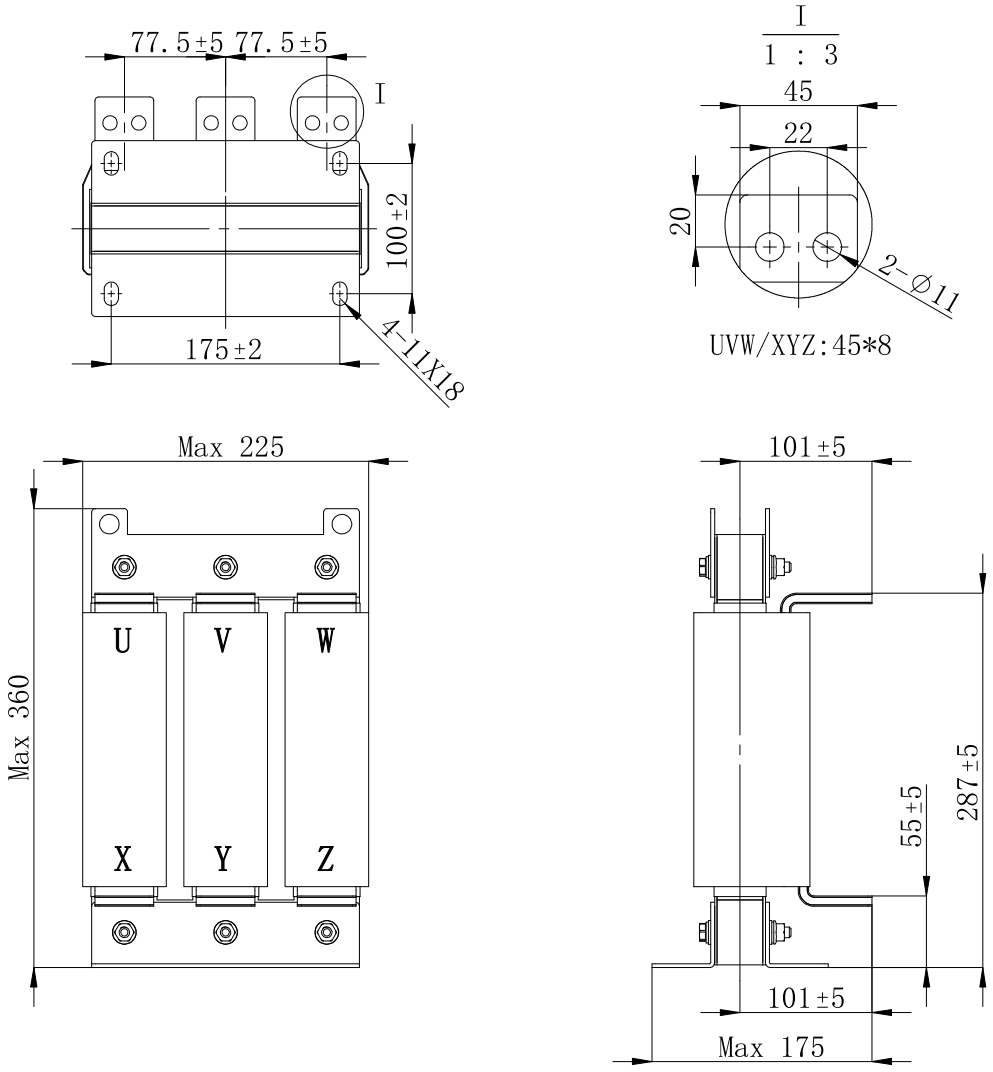


Figure 1-4

Parallel Circulating Current Reactor Delta #	kW	Rated Current (A)	Inductance Value (μH)	Saturated Current (Arms)	Consumption (W)	Dimension (mm)	UL Certification
DR770LP003P	355	770	2.93	1155	126.7	As shown in the figure above	Pass
	400						

Table 1-11

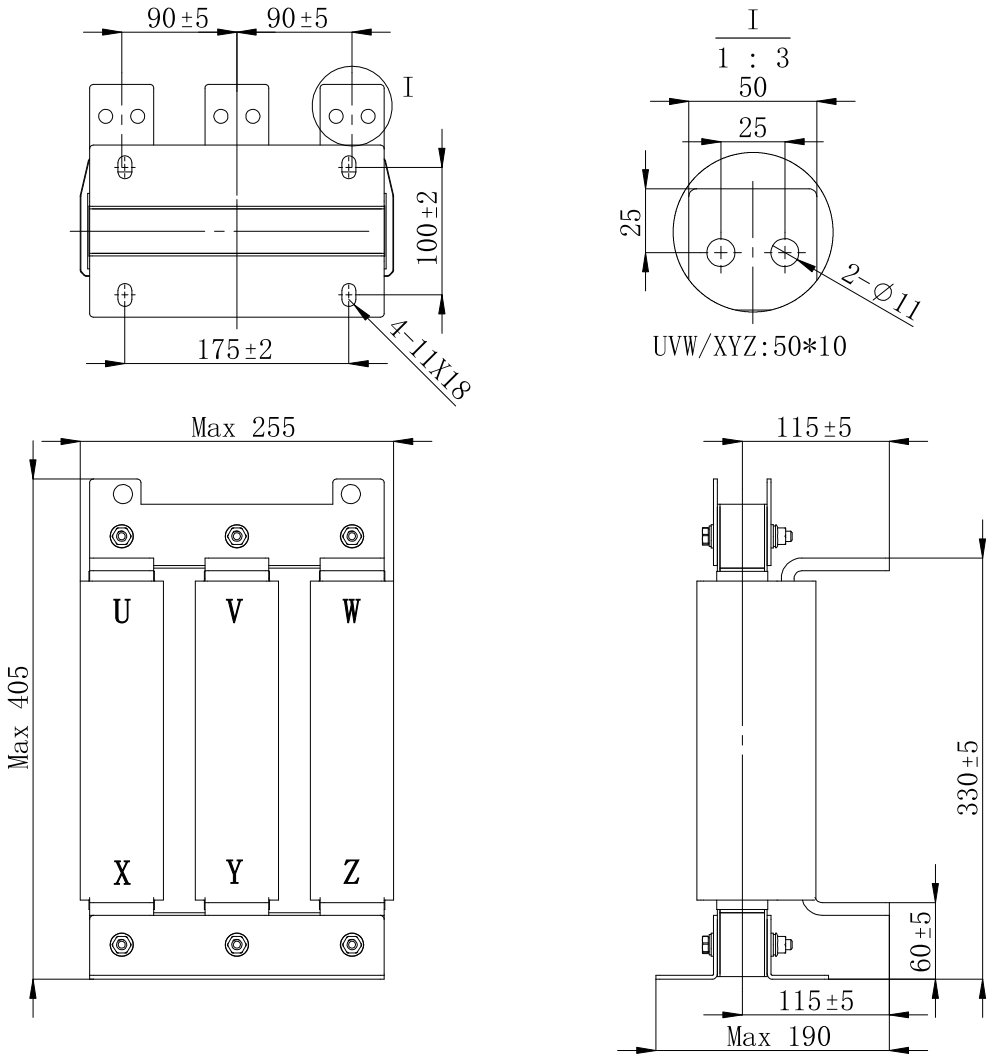


Figure 1-5

Parallel Circulating Current Reactor Delta #	kW	Rated Current (A)	Inductance Value (μH)	Saturated Current (Arms)	Consumption (W)	Dimension (mm)	UL Certification
DR930LP002P	450 500	930	2.41	1395	174	As shown in the figure above	Pass

Table 1-12

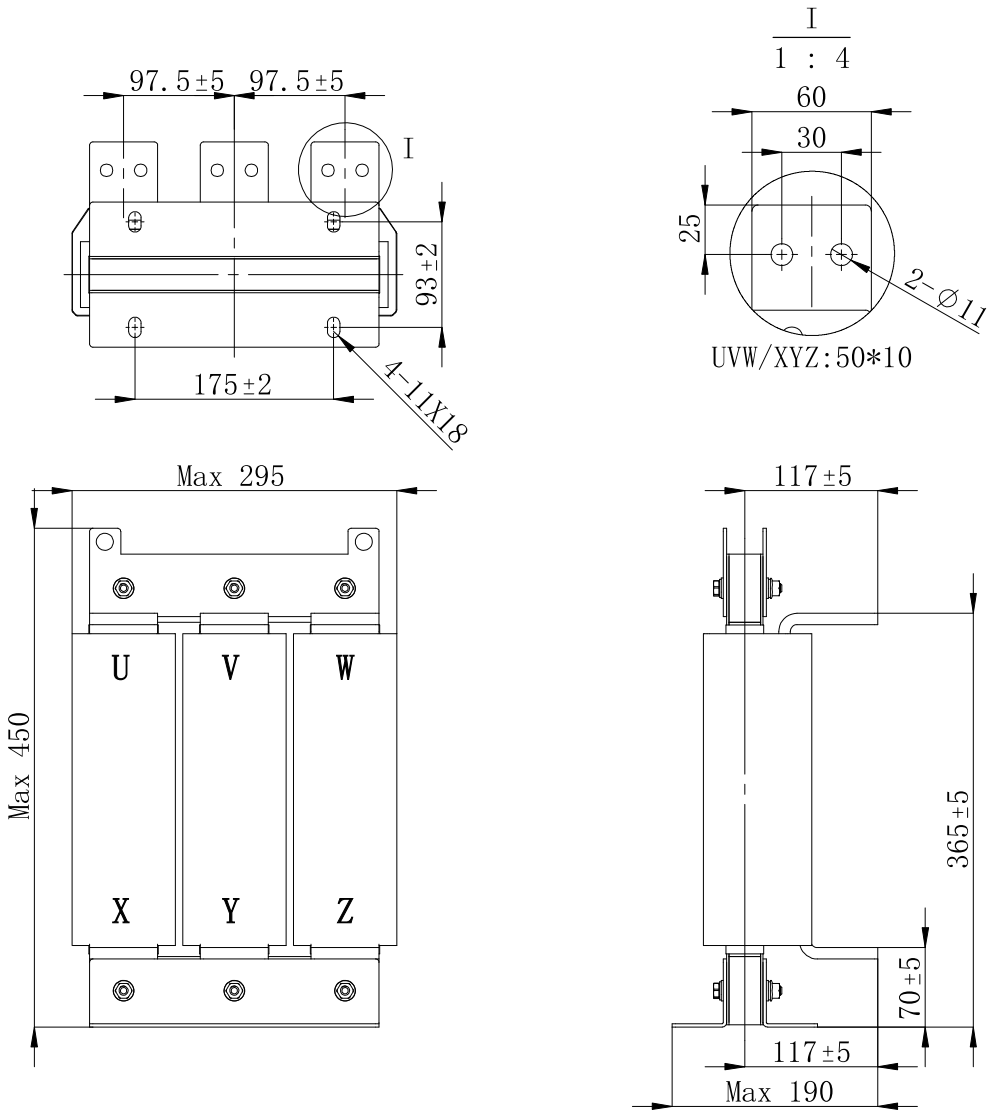


Figure 1-6

Parallel Circulating Current Reactor Delta #	kW	Rated Current (A)	Inductance Value (μH)	Saturated Current (Arms)	Consumption (W)	Dimension (mm)	UL Certification
DR1212LP002P	560	1212	1.82	1818	209.5	As shown in the figure above	Pass
	630						

Table 1-13

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Chapter 2 Wiring

2-1 System Wiring Diagram

After removing the front cover, verify that the power and control terminals are clearly noted. Read the following precautions before wiring.

DANGER

- ☑ Turn off the AC motor drive power before doing any wiring. A charge with hazardous voltages may remain in the DC bus capacitors even after the power has been turned off for a short time. Measure the remaining voltage with a DC voltmeter on +1/DC+ and DC- before doing any wiring. For your safety, do not start wiring before the voltage drops to a safe level (less than 25 V_{DC}). Installing wiring with a residual voltage may cause personal injury, sparks, and short circuit.
- ☑ Only qualified personnel familiar with AC motor drives are allowed to perform installation, wiring and commissioning. Make sure the power is turned off before wiring to prevent electric shock.
- ☑ Make sure that power is only applied to the R/L1, S/L2 and T/L3 terminals. Failure to comply may result in damage to the equipment. The voltage and current must be in the range indicated on the nameplate. Refer to the nameplate information in the User Manual of each models for details:
  - C2000 Plus User Manual (refer to Section 1-1): https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=22212&DocPath=1&hl=en-US
  - C2000-HS User Manual (refer to Section 1-1): https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=42836&DocPath=1&hl=en-US
  - C2000-R User Manual (refer to Section 1-1): https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=44189&DocPath=1&hl=en-US
- ☑ All units must be grounded directly to a common ground terminal to prevent damage from a lightning strike or electric shock and reduce noise interference.
- ☑ Tighten the screws of the main circuit terminals to prevent sparks caused by screws loosened due to vibration.

CAUTION

- ☑ For your safety, choose wires that comply with local regulations when wiring.
- ☑ Check the following items after finishing the wiring:
  1. Are all connections correct?
  2. Are there any loose wires?
  3. Are there any short circuits between the terminals or to ground?

2-1 System Wiring Diagram

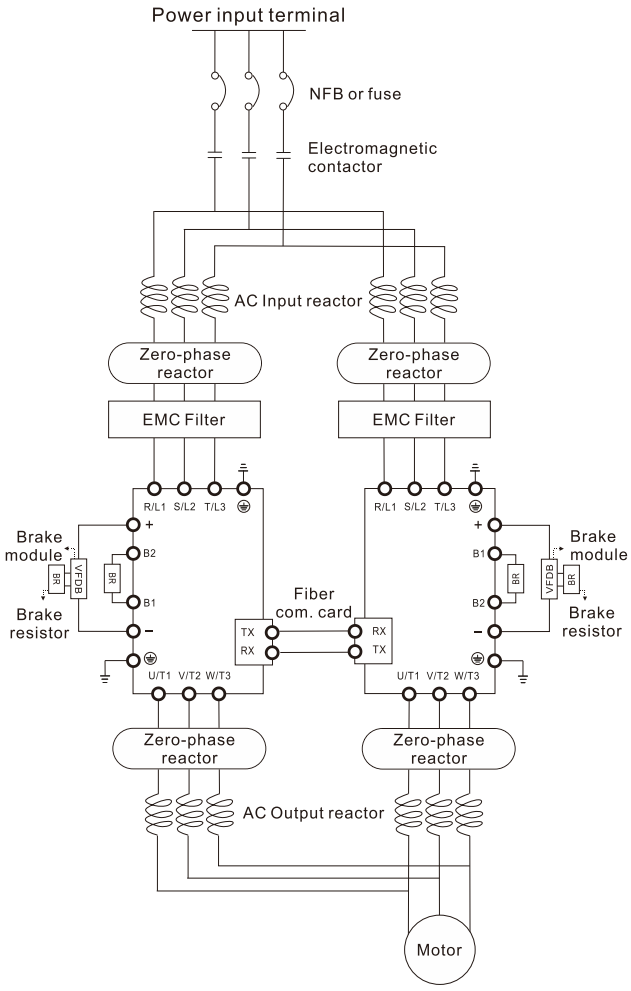

Figure 2-1

Power input terminal	Supply power according to the rated power specifications indicated in the manual.
NFB or fuse	There may be a large inrush current during power on.
Electromag-netic contactor	Switching the power ON/OFF on the primary side of the electromagnetic contactor can turn the drive ON/OFF, but frequent switching can cause machine failure. Do not switch ON/OFF more than once an hour. Do not use the electromagnetic contactor as the power switch for the drive; doing so shortens the life of the drive.
Brake module & Brake resistor (BR)	Used to shorten the deceleration time of the motor.
AC reactor (input terminal)	When the mains power supply capacity is greater than 500 kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated may destroy the internal circuit of the drive. It is recommended that you install an input side AC reactor in the drive. This also improves the power factor and reduces power harmonics. When the PN is connected, an input reactor must be installed to ensure proper rectifier operation. The wiring distance should be within 10 m.
Zero phase reactor	Used to reduce radiated interference, especially in environments with audio devices, and reduce input and output side interference. The effective range is AM band to 10 MHz.
EMC filter	Can be used to reduce electromagnetic interference.
Fiber communication card	Transmit information between master and slave through the fiber communication card.
Output Reactor	To prevent circulating currents from damaging the variable frequency startup during parallel connection, ensure the voltage phase sequence on both sides is the same. While the reactor has no directionality for input and output, maintaining this phase sequence is crucial.

Table 2-1

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Chapter 3 Parallel Application Introductions

3-1 Parameter Overview

The following describes the parameters related to parallel connection:

🗲 You can set this parameter during operation

00-62 Six-Phase Motor Master and Slave Settings

Default: 0

Settings 0–2

0: Single unit mode

1: Master mode

2: Slave mode

00-63 Optical Fiber Communication Card Software Version

Default: Read only

Settings Read only

🕮 Displays the current software version of the optical fiber communication card.

00-65 Six-Phase Motor Coil Offset Angle

Default: 0

Settings -360.0–360.0

🕮 Depending on the design considerations of the six-phase motor winding, the two windings may need to be electrically offset. Common offset angles are 0 degrees, 30 degrees, and 60 degrees. In the control architecture, the main control output voltage is typically adjusted by 30 degrees based on the motor structure before output. However, due to possible process or structural errors, the offset angle parameter can be fine-tuned to ensure consistency between the master and slave controls.

3-2 Parallel Setup Steps

3-2-1 C2000 Series Settings

The following is the setting process and descriptions of C2000 series parallel connection, re-power the drive after completing the set up.

3-2-1-1 C2000 Series Tuning

- Control and communication parameters can be set on the master drive
- Motor and protection parameters must be identical on both the master and slave drives
- Currently, only speed mode (Pr.00-10=0) is supported

3-2-1-2 Master Drive Parameter Setting

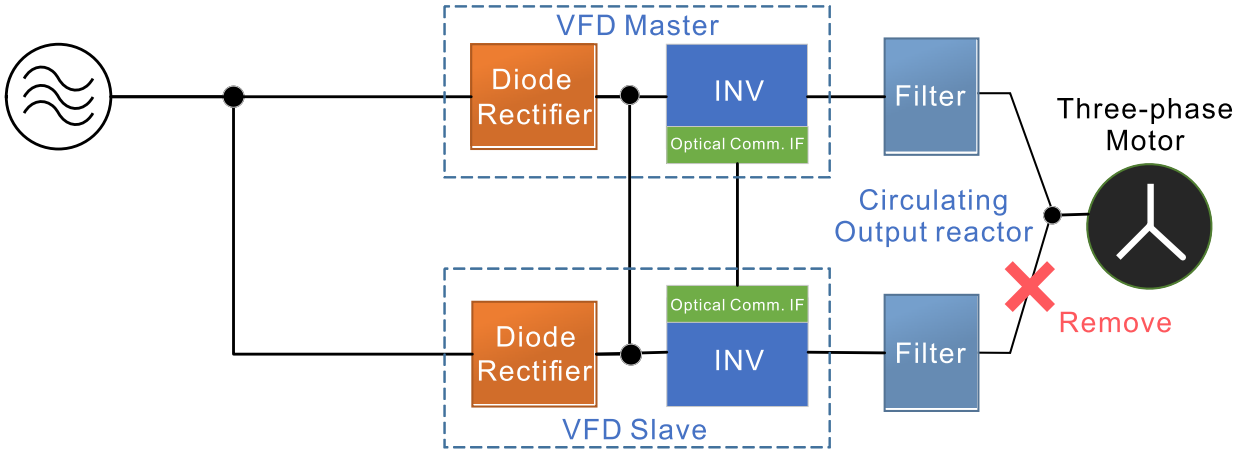
1. Set Pr.00-02 = 10 (Parameter reset).
2. Set motor parameters in the Parameter Group 05.
3. Set Pr.00-62 = 1 (Master unit).
4. Check Pr.00-63 (Fiber communication card firmware version).
5. Set Pr.00-64 = 8 (Keypad setting: bit3 = 1, Parallel start).
6. Set Pr.00-11 according to the required mode (Currently supports IMVF and PM Sensorless).
7. Set Pr.00-17 carrier frequency (less than 6 kHz).
8. Set Pr.11-00 = 9.
9. Set Pr.10-53 = 1 (Only required for PM Sensorless).
10. Set parameters for Group 10 and Group 11.
11. Set Pr.00-04 to obtain the motor information: Pr.00-04=73 (output current), 74 (output power) and 75 (output torque).

3-2-1-3 Slave Side Parameter Setting:

1. Set Pr.00-02 = 10 (Reset parameters).
2. Set motor parameters in Parameter Group 05.
3. Set Pr.00-62 = 2 (Slave unit).
4. Check Pr.00-63 (Fiber communication card firmware version).
5. Set Pr.00-64 = 8 (bit3 = 1, Parallel start).
6. Set Pr.01-34 = 2 (minimum frequency)
7. Set Pr.00-11 according to the required mode (Currently supports IMVF and PM Sensorless).
8. Set Pr.00-17 to match the master drive’s setting value.
9. Set Pr.00-20 = 9.
10. Set Pr.00-21 = 6.
11. Set Pr.11-00 = 9.
12. Set Pr.10-53 = 0.
13. Set parameters for Group 10 and Group 11.

3-2-1-4 Motor Parameter Autotuning

- In parallel model, the master drive must switch back to single unit mode before executing motor parameter autotuning, Pr.00-62 = 1 (master mode) changes to 0 (single unit mode). Be aware that the output side wiring of the Slave must be removed (as shown in the following figure), otherwise there is a risk of the Slave boosting the voltage.

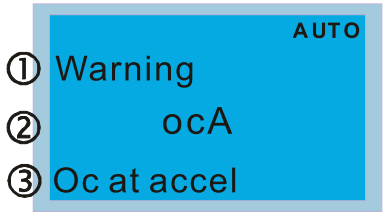


- When driving a permanent magnet synchronous motor, execute the parameter autotuning according to Pr.05-00 settings.
- When driving an inductance motor and using speed tracking function by the motor vector flux (Pr.07-12 = 4), set the simple rolling auto-tuning for IM according to Pr.05-00 settings.
- After the autotuning is completed, re-connect the output wiring to the Slave and change the single unit mode back to master mode (Pr.00-62 = 1).

Chapter 4 Fault Codes and Descriptions

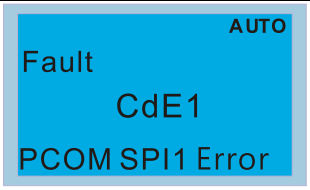
Summary of Fault Codes

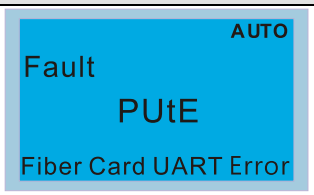
ID No.	Fault Name
213	Slave Error (SLEr)
214	SPI Tx Error (CdE1)
215	Fiber Card UART Error (PUtE)
216	SPI Rx Error (CdE2)
217	PCOM Data Loss (PDlE)
218	PCOM Torque Error (PSTq)

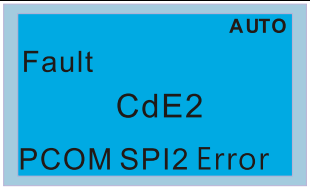


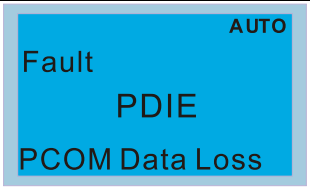
① Display error signal
② Abbreviate error code
③ Display error description

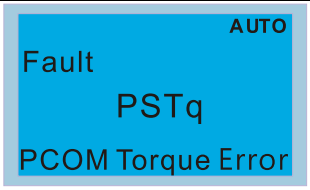
ID	Display on LCD Keypad	Fault Name	Fault Descriptions
213	AUTO Fault SLEr Slave Error	Slave Error (SLEr)	Slave error: this fault code only displays on the Master drive.
Action and Reset			
Action Condition		Slave Error	
Action Time		Act immediately	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Clear slave error codes before manual reset	
Record		Yes	
Cause		Corrective Actions	
Slave Error		Check slave error code and resolve the issue to reset.	

ID	Display on LCD Keypad	Fault Name	Fault Descriptions
214		SPI Tx Error (CdE1)	CRC error occurs during data transmission from the drive to the fiber card
Action and Reset			
Action Condition	CRC error occurs during data transmission from the drive to the fiber card		
Action Time	Act immediately		
Fault Treatment Parameter	N/A		
Reset Method	Manual reset		
Reset Condition	The drive and fiber card reconnect normally		
Record	Yes		
Cause	Corrective Actions		
Fiber card abnormal	1. Check if the fiber card is installed firmly. 2. If the issue persists, replace the fiber card, and contact Delta.		

ID	Display on LCD Keypad	Fault Name	Fault Descriptions
215		Fiber Card UART Error (PUtE)	UART communication error between fiber cards
Action and Reset			
Action Condition	UART communication error between fiber cards		
Action Time	Act immediately		
Fault Treatment Parameter	N/A		
Reset Method	Manual reset		
Reset Condition	Communication between master and slave fiber cards has been restored		
Record	Yes		
Cause	Corrective Actions		
Abnormality between fiber cards or cables	1. Check if the fiber cards or fiber cables is installed firmly 2. If the issue persists, replace the fiber cards and cables, and contact Delta.		

ID	Display on LCD Keypad	Fault Name	Fault Descriptions
216		SPI Rx Error (CdE2)	CRC error occurs during data transmission from the fiber card to the drive
Action and Reset			
Action Condition	CRC error occurs during data transmission from the fiber card to the drive		
Action Time	Act immediately		
Fault Treatment Parameter	N/A		
Reset Method	Manual reset		
Reset Condition	The drive and fiber card reconnect normally		
Record	Yes		
Cause	Corrective Actions		
Abnormality between fiber cards or cables	1. Check if the fiber cards or fiber cables is installed firmly 2. If the issue persists, replace the fiber cards and cables, and contact Delta.		

ID	Display on LCD Keypad	Fault Name	Fault Descriptions
217		PCOM Data Loss (PDIE)	UART disconnect between fiber cards
Action and Reset			
Action Condition		UART disconnect between fiber cards	
Action Time		Act immediately	
Fault Treatment Parameter		N/A	
Reset Method		Manual reset	
Reset Condition		Reconnect between fiber cards	
Record		Yes	
Cause		Corrective Actions	
Fiber card or fiber cable disconnection		Turn off the AC motor drive power and check if the fiber cards and cables are securely connected	

ID	Display on LCD Keypad	Fault Name	Fault Descriptions
218		PCOM Torque Error (PSTq)	Abnormal torque distribution
Action and Reset			
Action Condition	More than 50% difference in torque distribution between master and slave		
Action Time	Act immediately		
Fault Treatment Parameter	N/A		
Reset Method	Manual reset		
Reset Condition	Reset immediately		
Record	Yes		
Cause	Corrective Actions		
More than 50% difference in torque between master and slave	1. Check if the drive parameters meet the description in parallel control manual. 2. Check if the drive wiring is correctly installed on the motor side.		

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