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User Manual

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PREFACE

Thank you for choosing the VFD-S General Purpose Series Variable Frequency Drives. This manual will provide you with the detailed steps and precautions regarding installation, wiring, setting of functional parameters, routine maintenance, malfunction diagnosis and solution etc.

The VFD-S series of drives focuses on providing you with the best levels of scalar control of asynchronous AC motors. Through the adoption of the most advanced PWM technologies driven through one of the most powerful DSP control systems, this drive is armed with optimized functions and flexibility to drive a myriad of applications with stable performances as per your requirements.

To utilize the drive to its full function and ensure the safety of both users and the product, please read this manual carefully before using the drive. Any incorrect operations may lead to fault, malfunction or shortened lifetime, even damage to the device or the people around it.

This manual is available on our website and is accessible through the QR code provided on the unit We request you to keep it safety considering its importance in commissioning, inspection, and maintaining the product. In the pursuit of constant improvement, kindly note, that this manual is subject to modification without any notice.

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6DIHW\ SUHFDXWLRQV

Read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the variable frequency drive (VFD). Ignoring the instructions can damage the product or cause harm to the people operating or being present in the vicinity of the system.

:DUQLQJ

People working on the device should take part in professional electrical and safety training, receive relevant certification and be familiar with all steps and requirements of installing, commissioning, operating and maintaining the device to avoid any hazards.

6DIHJXLGHOLQHV

- In any case, the AC power lines SHOULD NOT be connected to the output terminals viz. U, V or W
- Do not touch the internal components for your own and the product's safety
- Only qualified professional engineers are allowed to assemble, wire, commission or maintain the converter
- The drive must be installed in an appropriate operating environment and far away from humidity or water drops; care must be taken to protect it from direct sunlight or being overheated
- Do not conduct the procedure of inspection or maintenance until the drive has been shut down for at least 3 minutes or as mentioned on the drive terminal cover
- No permission is granted to change or modify the internal components or circuits

'HOLYHU\ LQVSHFWLRQ

Pre-dispatch inspection for each drive is implemented strictly by our QC department. The packaging is adequately strengthened with special packing materials which protects it from justifiable levels of harm that could come its way during handling and transportation.

However, as an added precaution, we request you to kindly check the following points upon receipt of the device -

- Please check for any damage caused during the transportation
- Please check if the enclosed documents are all inside the case namely the manual and test report
- Please check if this is the model of the product for which you placed an order
- Please check if you have received the right converter accessories as per your order

, Q V W D O O D W L R Q

, Q V W D O HOQDYWLLURQQ P H Q W

- The surroundings must be free from dust, caustic/corrosive/inflammable gases/liquids
- There shouldn't be any conductive particulates in the surrounding air
- The ambient temperature should be -10 °C ~ +60 °C. Sufficient ventilation should be available
- Ensure a solid base without vibration

, Q V W D O LOQDVWLLURXQP WGSRDRVH L P L W

- To minimize the heat effect on each other, if two or more converters are installed in the same control cabinet, they should be installed horizontally abreast; A baffle plate must be set up between them if, for some reason, they have to be installed vertically. It should be installed on a fire and heat proof frame, for example, a metal frame, to prevent risks of a fire hazard
- It should be mounted by screws vertically; upside-down, slant or horizontal mountings are not allowed
- Ensure spare space around the drive to enable adequate ventilation for it to maintain its temperature during operation
- Care must be taken to ensure that ambient temperature is within the operating range when the drive is installed inside a control cabinet

Fig.2.1 Separation while installation

: , 5 , 1 *

1. For the safety of user as well as device, only professional engineers or equally qualified persons are allowed to operate it. Please pay attention to the following precautions while wiring
2. The device must be isolated from any type of power supply before accessing the terminals of the drive. If the drive is already installed and is in working condition, then to change the wiring, first turn off the drive, wait for the capacitors to get fully discharged and then isolate it from input supply. Afterwards it is allowed to do required changes in the wiring
3. Ensure that the PE earth terminal of the device is properly connected to earth. The earth connection impedance must not be greater than 10 ohms
4. Input power must be connected to terminals R, Y and B while motor terminals must be connected to U, V and W. Use lugs to avoid connections error such as loose connections or short circuit of wires

   (Kindly refer Appendix B for lugs sizes). Any miss-matched connection can cause damage to the device
5. The reliablity of wires and terminals must be evaluated before wiring
6. To avoid contact with the terminals, always keep the terminal cover closed and do not touch them

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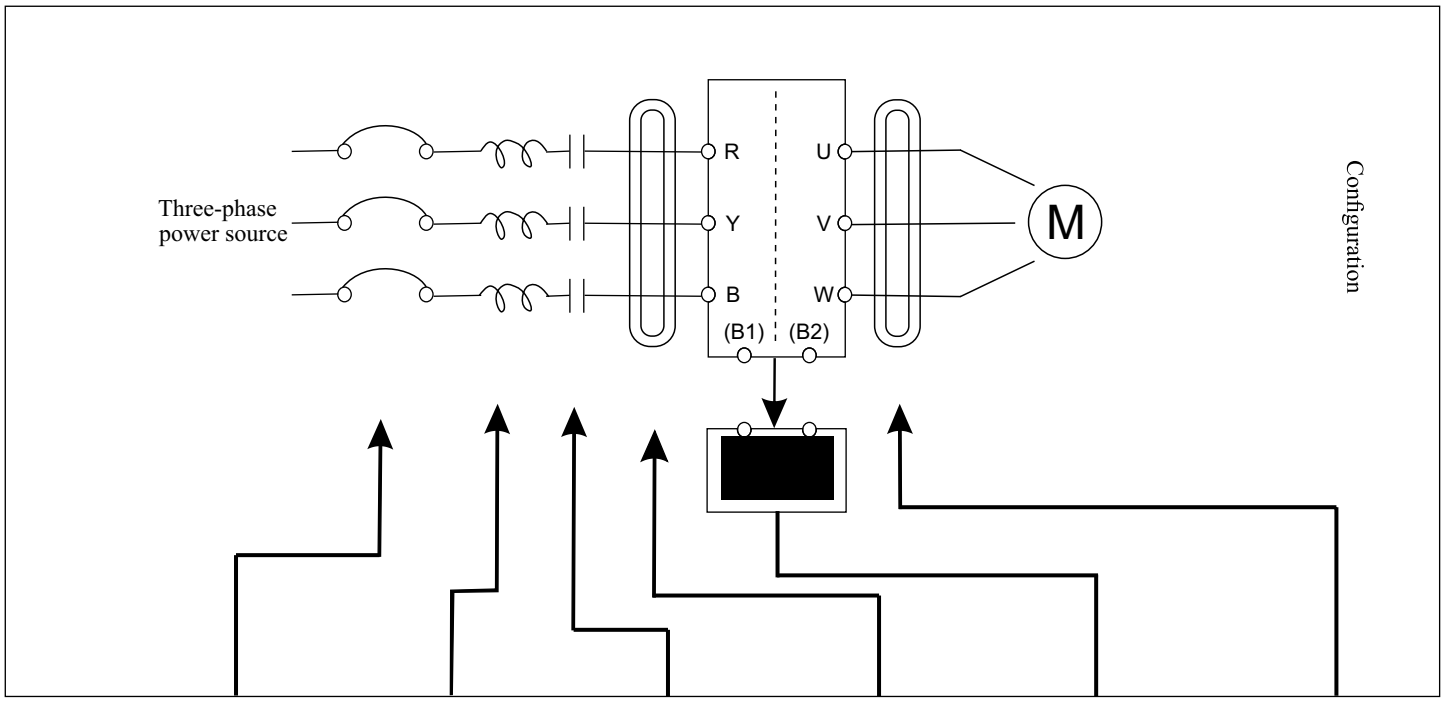
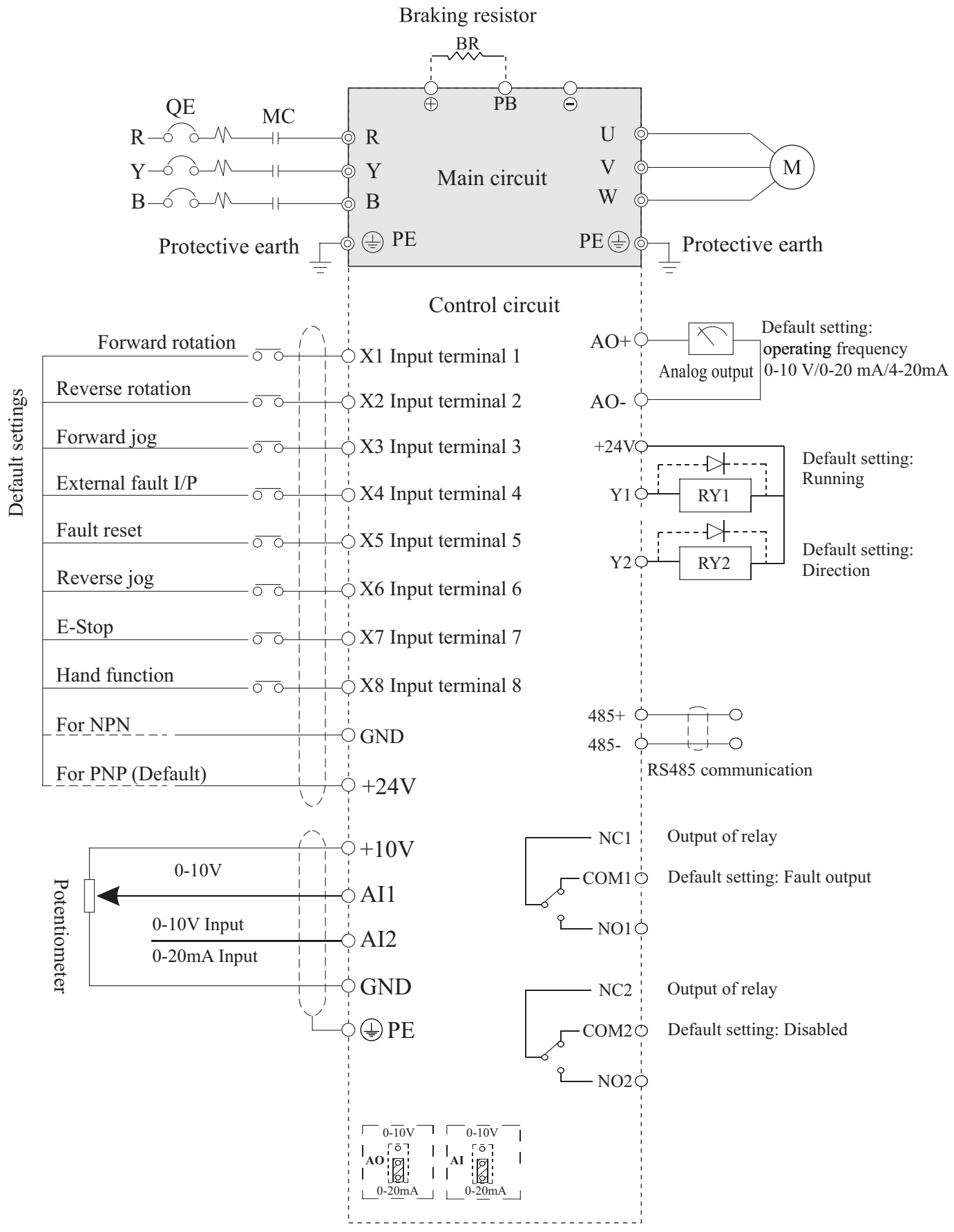


Fig.3.1 Connection method for assorted devices

1DPH	)XVH	$& UHDFWRU	(OHFWURPDJQHWLF FRQWDFWRU	)LOWHU	%UDNLQJ 5HVLVWRU	)LOWHU
'HVFULSWLRQV	Appropriate model should be selected; its rated current must be no less than 1.5 times the rated current of converter	It's applied for the Improvement of input power factor	It's used to control the switching of power source	It's used to reduce the radio interfer-ence generated by converter	It's applicable when the braking torque doesn't meet basic requir-ements, or when inertia load is so large that converter needs to be stopped frequently or in a short time. Refer appendix.	It's used to reduce the radio interference generated when the motor is situated at long distances from the drive.

6WDQGDUG ZLULQJ GLDJUDP IRU + +



1 R W PNP & NPN settings can be changed in P5-12

'HVFULSWLRQ RI WHUPLQDOV

7HUPLQDO V\PERO FRGH	)XQFWLRQDO GHVFULSWLRQV
R, Y, B (POWER)	Terminals for three-phase AC input 415V
U, V, W (MOTOR)	Output terminals, connect with three-phase AC electromotor
+, PB (BR)	Terminals for braking resistor (Optional)
⏚ / PE	Terminal of ground (Earth terminal)
–	+, - DC Bus +VE and -VE terminal

For safety's sake, please connect wires according to the regulations of national electrical code while proceeding wiring.

& RQQH FWLRQ RI LQSXW SRZHU WHUPLQDOV

The input supply to the converter must be connected via additional circuit breaker / contactor to protect the device from any input fault. (Tip: R-C surge absorbers should be added to the ends of electromagnetic contactors). An additional Earth Leakage Relay can also be installed as a protective device for electric leakage, the sensitivity should be more than 200 mA and actuation time should not be less than 0.1 seconds to prevent Earth Leakage Relay from malfunctioning. After the input circuit breaker / contactor an AC reactor should be used to protect the converter from high voltage and high current spikes from the grid. AC reactor also helps in improvement of power factor. Refer appendix A for the recommended reactor values for the specific drive rating that you've chosen. The turn on and off action of the motor should not be controlled by directly controlling the input supply to the drive. Instead it is recommended to control it by using the RUN / STOP command buttons on the VFD across the various control sources available. If it not possible to control the turn on and off using the drive controls and has to be controlled using the terminal supply, then it is recommended to perform minimum attempts of switching as it can cause the drive components to degrade. The VFD must not be power cycled more than 2 times per hour in that case with the time between each power cycle no shorter than 30 mins. Always operate the drive under the recommended operating conditions. In cases where this is not possible, kindly contact Selec's helpline to check for the suitability of the VFD in the operating conditions of your site.

& RQQH FWLRQ RI RXWSXW SRZHU WHUPLQDOV

Output terminals must be connected in proper sequence to the terminals. If the sequence is interchanged the motor will run in opposite direction. If such case is encountered, exchange any two wires among U, V, and W. Alternatively, the direction can be changed from the drive settings, also. Never connect output terminals to phasing capacitors or surge-absorber. If the length of wire connected to converter at output side is more than 50 meters, a large amount of leakage will be caused due to capacitors between the wiring, which may lead to over current. In this case output filter is highly recommended. To protect the motor insulation from getting damaged, an additional output reactor must be installed. An additional noise filter should be installed to minimize the radio interference generated by the converter.

% U D NLQJ UHVLVWRU RU EUDNLQJ XQLW

If the motor is driving a very high load, then at the time of turn off, a high inertia can cause the rotor to take large time to stop completely. In operations where a short time turn off or frequent switching is required, braking resistor or braking units must be selected and installed. Depending on the drive that you've selected, either an internal braking unit OR DC bus terminals may be available on the power terminals. Braking resistors or braking unit improve braking capacity by improving braking torque. Terminals B1 and B2 must be connected to braking resisitor (Note: If B1 and B2 terminals are present then it represents that the drive has built in braking unit). If there are no B1 and B2 terminals present; and instead positive (+) and negative (-) terminals are present, then these should be connected to external braking unit. Do not connect these terminals to external braking resistor. The recommended values for the braking resistors for diffrent variants of VFD are given in Appendix B, kindly refer to it.

(DUWKLQJ WHUPLQDO ⏚

For safety purpose, earth terminal must be properly grounded to reduce the chance of any shock from the body and noise. It is highly recommended to use the standard ground lead which should be short and thick (its grounding impedance should not exceed 10 ohm). Do not connect the grounding lead of the converter to that of any other devices terminals. The correct method of providing the grounding to the unit is specified in the figure below. All the converters must be connected to the same earth terminal directly if two or more converters are installed together.

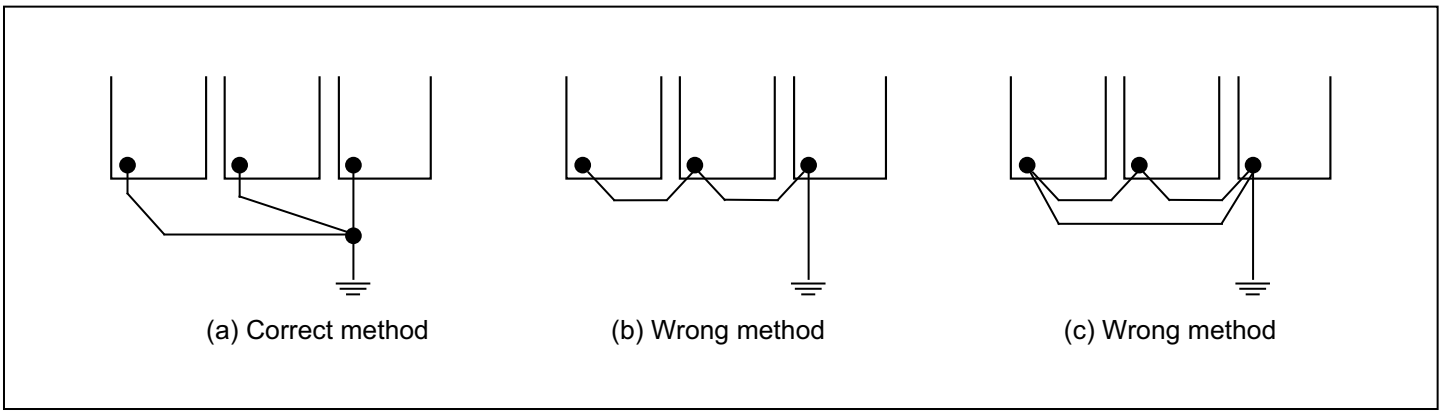


Fig.3.3 Earthing method

BR			POWER			⏚	MOTOR		
⊕	PB	⊖	R	Y	B	PE	U	V	W

([SODQDWLRQV RI FRQWURO ORRS WHUPLQDOV

NO1	COM1	NC1	NO2	COM2	NC2	+24V	X1	X2	X3	X4	X5	X6
+10V	GND	AI1	AI2	AO+	AO-	GND	Y1	Y2	X7	X8	485+	485-

,WHP V6\PERO	7HUPLQDO QDPH	'HVFULSWLRQ 'HIDXOW VH
1	AO+	Analog output signal positive terminal	Positive terminal for analog output (0 - 10V / 0-20mA) signal generation
2	AO-	Analog output signal negative terminal	Negative terminal for analog output (0 - 10V / 0-20mA) signal generation
3	AI1	Analog input terminal 1	Terminal for Analog input (0-10 V) signal
4	AI2	Analog input terminal 2	Terminal for analog input (0-10V/ 0-20mA) signal
5	GND	Control terminals ground	Ground for control terminals
6	X1	Multifunction input terminal 1	Default setting : FWD
7	X2	Multifunction input terminal 2	Default setting : REV
8	X3	Multifunction input terminal 3	Default setting : FWD JOG
9	X4	Multifunction input terminal 4	Default setting : Ext Fault
10	X5	Multifunction input terminal 5	Default setting : Fault Reset
11	X6	Multifunction input terminal 6	Default setting : Reverse Jog
12	X7	Multifunction input terminal 7	Default setting : E-Stop
13	X8	Multifunction input terminal 8	Default setting : Hand Function
14	GND	Control terminals ground	Ground for control terminals
15	Y1	Multifunction transistor output 1	Default setting : Running
16	Y2	Multifunction transistor output 2	Default setting : Direction
17	+24V	24V supply	+24VDC 50mA

18	NC1	Multifunction relay output NC terminal	Default setting: Fault output
19	COM1	Multifunction relay output COM terminal	
20	NO1	Multifunction relay output NO terminal	
21	NC2	Multifunction relay output NC terminal	Default setting: Disable
22	COM2	Multifunction relay output COM terminal	
23	NO2	Multifunction relay output NO terminal	
24	+10V	10V supply	+10V DC 15mA
25	+485	RS 485+	Communication input positive terminal
26	-485	RS 485-	Communication input negative terminal

Multi-core shielded cable or stranded wire should be used to connect control terminals. The terminal which is closed to the converter must be connected to earth terminal PE. When wiring, the control cables must be kept away from the main circuit and high-current circuit by at least 30cm. Instead of parallel wiring, vertical wiring should be adopted to prevent the drive from malfunctions resulting from external interference.

.H\ERDUG DQG 3DQHO

,OOXVWUDWLRQ RI NH\SDG

Fig.4.1 Illustration of keyboard

8QLWV /('V GHVFULSWLRQV

/('	)XQFWLRQ
V	Denotes that the value being shown is a voltage
A	Denotes that the value being shown is a current
Hz	Denotes that the value being shown is a frequency

)XQFWLRQ /('V GHVFULSWLRQV

/('	)XQFWLRQ
RUN	Denotes that the drive status. OFF - Drive is Stopped ON - Drive is Running Blinking - Drive is Stopping
F/R	Denotes the direction of operation of the drive. OFF - forward ON - reverse
L/R	Denotes the source of control for the drive. OFF - local control using the keypad, ON - remote control
ERR	Denotes presence of error condition BLINKING - pre-alarm condition triggered STEADY - fault condition triggered

.H\V GHVFULSWLRQ

1DPH	.H\	)XQFWLRQ
ESC		1. Go to the previous programming level, 2. Cycle online display pages (Backward Direction)
PRG		1. Press and hold the key for 3 seconds to enter programming mode, 2. Save setting value, 3. Cycle online display pages (Forward Direction)
STP/RST	STP / RST	1. Stop drive operation, 2. Reset fault
RUN		1. Start drive operation
JOG / REV		1. Perform jogging operation, 2. Perform direction reversal
Panel encoder	●	1. Clockwise - increment editable value being shown on screen 2. Anti-Clockwise- Decrement editable value being shown on screen 3. Press - enter programming menu; Save setting value
Up key (△)		1. Increment displayed editable value
Down key (▽)		2. Decrement displayed editable value
HAND		1. Triggers the hand function

,OOXVWUDWLRQV RI NH\ERDUG RSHUDWLRQV

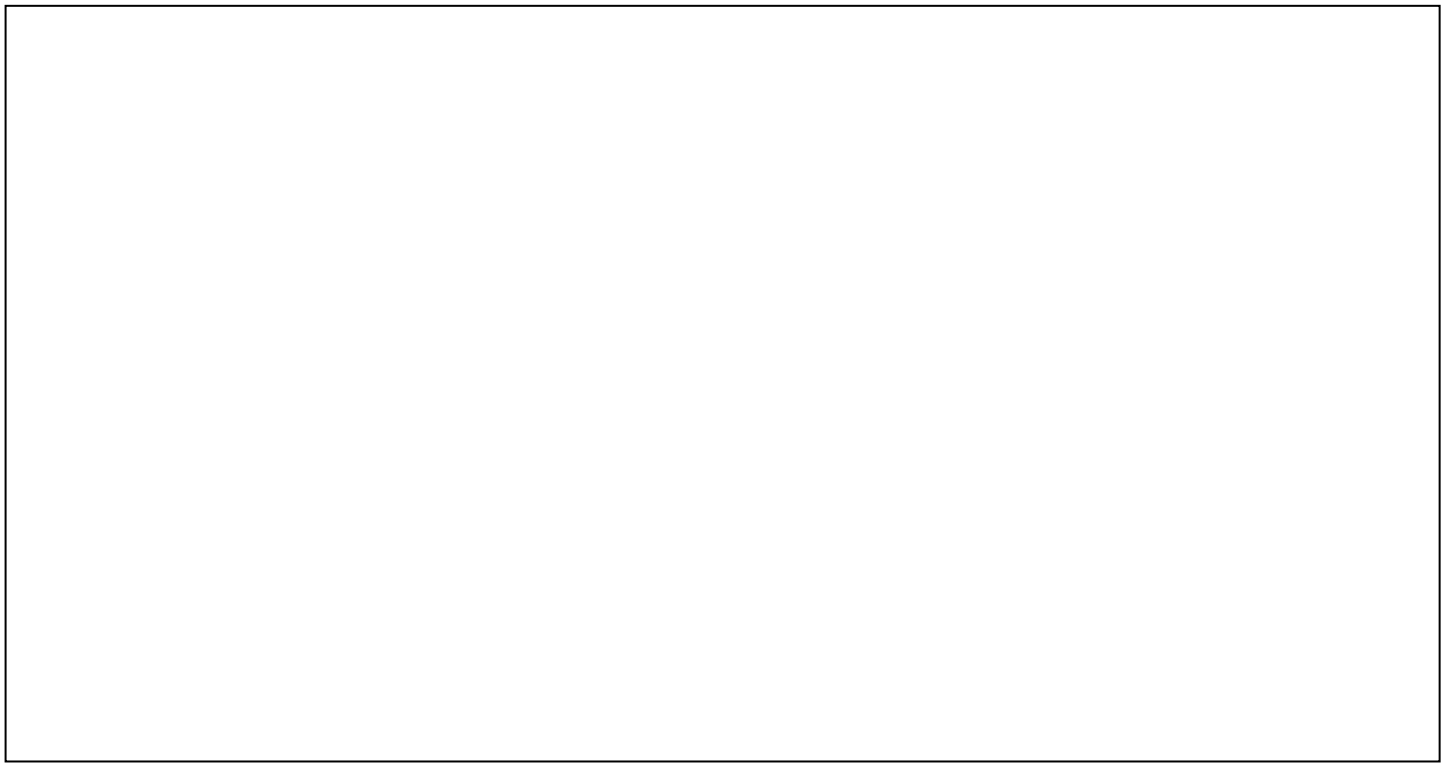


Fig.4.2 Illustration of keyboard operations

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&KHFNLQJ IRUWXQQLQJ

- Please confirm that there is no short circuit between terminals or any exposed charged component
- Do not connect the unit to the power supply until the enclosure is assembled and closed
- Please check whether the wiring is correct or not, especially output terminals (U, V, W) which mustn't be connected to the power source; additionally, earth terminals PE must be well-grounded as well
- Please confirm that all the components, such as terminals, pluggable connectors, or screws are fastened
- Make sure that all the switches are off before it's connected to a power source, and that the converter will not malfunction or be accidentally started when switched on
- It is recommended to use appropriately sized lugs instead of free wires to prevent rogue strands from creating a short between adjacent terminals

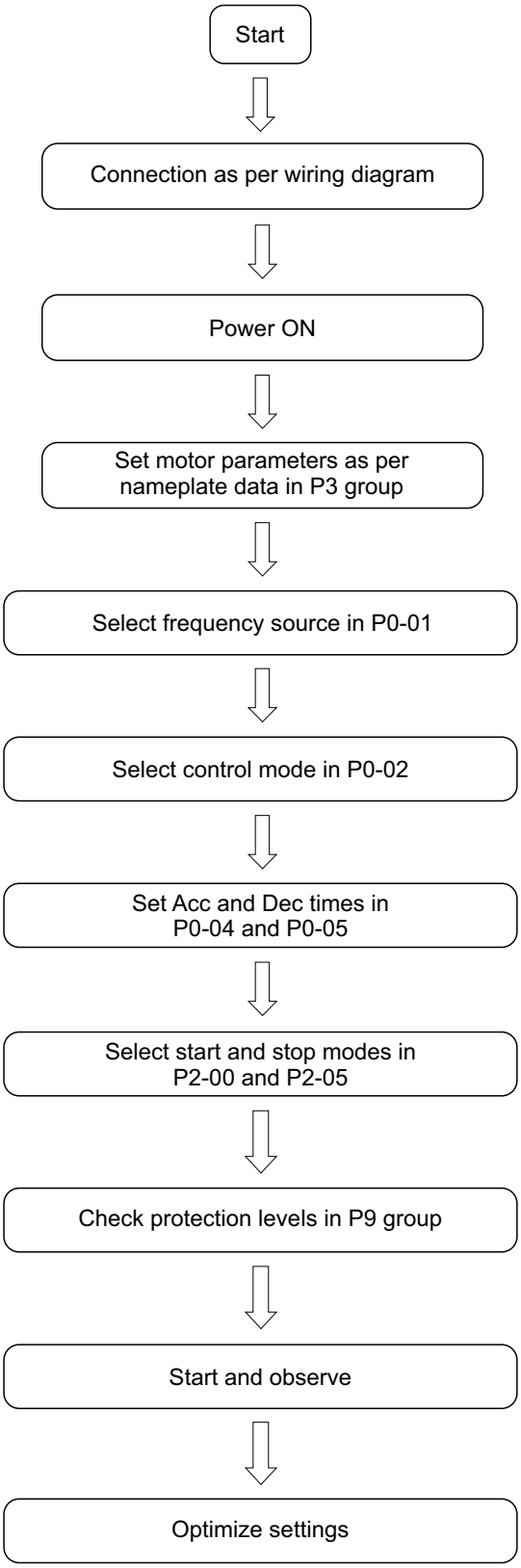
&RPPLVVLRQLQJ

- The drive wirings must be checked and confirmed comprehensively before commissioning
- Its default running mode is to be controlled through the keyboard and panel
- It is recommended that post initial settings, the user start by checking the jogging function. The default jog frequency is 5.0Hz. Check whether the motor is rotating in the right direction
- Check if its rotation is smooth (No abnormal noise or vibration should be observed)
- Check if the acceleration or deceleration of the motor is stable
- If the drive functions properly, please preset its operating frequency first; please press the START button to start running and check whether its output current/voltage is normal
- Only then start using the drive in your regular operations

If the drive or the system as a whole responds unexpectedly, use the STOP/RST key to stop the operation of the drive immediately. Meanwhile, check Chapter 7 for a guide on debugging the commonly faced faults

Even after drive operation is stopped, there could be a risk of electrical shock on the terminals of the unit as long as the mains are connected. It is therefore strongly advised that any kind of operation on the terminals should only be undertaken after switching OFF the mains and waiting for adequate time for the DC bus capacitors to discharge

4XLFN FRPPLVVLRQLQJ



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) X Q F W L R Q D O S D U D P H W H U V W D E O H

For ease of programming, the settings have been classified into basic and advanced as mentioned in the table below.

"○": It indicates that the specified parameter can be varied irrespective of the drive's run-state

"●": It indicates that specified code parameters cannot be changed or modified while the drive is running.

"×": It indicates that code parameters are read-only, which cannot be changed or modified.

3 % D V L F I X Q F W L R Q D O S D U D P H W H U V

) ; & R G H	' H V F U L S W L R Q	6 H W W L Q J V D Q G 5 D Q J H	' H I D X O W 9 D O X H	% D V L F 6 H W W L Q J	0 R G L I L F D W L R Q	0 R G E X V $ G G U H V V
P0-00	Parameter setting mode	0: Display only basic parameters 1: Display all settable parameters 2: Disable parameter settings 3: Factory reset	0	Yes	●	40000
P0-01	Frequency setting mode	0: Keypad UP / DOWN Keys 1: Keypad encoder 2: External POT 3: External AI; 4: PI regulation 5: Terminal setting using step size 6: Terminal setting using step size; Set frequency 0Hz after stop 7: Communication	1	Yes	●	40001
P0-02	Control mode for running	0: Controlled by keyboard 1: Controlled by terminal & Stop key disabled 2: Controlled by terminal & Stop key enabled 3: Controlled by communication	0	Yes	●	40002
P0-03	Frequency setting	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	50.0 Hz	Yes	x	40003
P0-04	Acc. time 0	0.1s-3600.0s	20.0s	Yes	○	40004
P0-05	Dec. time 0	0.1s-3600.0s	20.0s	Yes	○	40005
P0-06	Default running direction	0: Default direction 1: Reverse direction	0	Yes	●	40006
P0-07	Anti-reversion setting	0: Disable; 1: Enable	0	Yes	●	40007
P0-08	Max. frequency	Upper limiting frequency (P0-09) - 400.0 Hz	60.0 Hz	Yes	●	40008
P0-09	Upper limiting frequency	Lower limiting frequency (P0-10) - max. frequency (P0-08)	50.0 Hz	Yes	●	40009
P0-10	Lower limiting frequency	0.0 Hz-Upper limiting frequency (P0-09)	0.0 Hz	Yes	●	40010
P0-11	Jog frequency	0.0Hz- Upper limiting frequency (P0-09)	5.0 Hz	Yes	○	40011
P0-12	Carrier frequency	Depends on model	Depends on model	No	●	40012
P0-13	Auto storage of keyboard frequency in case of power down	0: Retention after power down 1: No retention on power down	1	No	○	40013
P0-14	Default frequency for non-retention	Lower limiting frequency (P0-10) – Upper limiting frequency (P0-09)	50.0 Hz	No	○	40014

3 .H\SDG SDUDPHWHUV

); &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLIL FDWLRQ	0RGEXV $GGUHVV
P1-00	Default startup display parameter	0: Set frequency 1: Output frequency 2: Output current; 3: Bus voltage 4: Rotational speed of motor 5: IGBT temperature 6: Output voltage 7: Output power 8: Percentage of output current 9: Linear speed 10: Count value 11: PI Index value (PI set value) 12: PI Feedback value 13: Input terminal status 14: Output terminal status 15: Rated power	0	Yes	○	40100
P1-01	Runtime display parameters	Same as for P1-00	1	Yes	○	40101
P1-02	Selection of display information	Count from 0 to 15 as given in P1-00	4	Yes	○	40102
P1-03	Display co-efficient of frequency	0.01-99.99	1.00	No	○	40103
P1-04	Display coefficient of mechanical speed	1.0-25.0	1.0	No	○	40104
P1-05	Display co-efficient of linear speed	0.001-9.999	1.000	No	○	40105
P1-06	Jog/Rev function selection	0: Jog 1: FWD/REV switching	0	Yes	●	40106
P1-07	Password	0: Disable; 1: Enable	0	Yes	○	40107
P1-08	Set password	1-9999	1	Yes	○	40108
P1-09	Frequency switch source	0: Keypad UP / DOWN keys 1: Keypad encoder 2: POT (potentiometer input) 3: AI (Analog input) 4: Terminal setting step size 5: Communication	0	Yes	○	40109
P1-10	Reference frequency	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.0 Hz	Yes	○	40110

3 6WDUW DQG 6WRS SDUDPHWHUV

); &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLIL FDWLRQ	0RGEXV $GGUHVV
P2-00	Start mode	0: Direct start 1: DC braking start	0	Yes	●	40200
P2-01	Starting frequency	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.5 Hz	Yes	●	40201
P2-02	Retention time for starting	0.0-50.0s	0.0s	Yes	●	40202
P2-03	Braking current before starting	0-150%	50%	Yes	●	40203

)\; &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW %DVLF 9DOXH	0RGLI\ GXULQJ 6HWWLQJ	0RGLILFDWLRQ $WWULEXWH	0RGEXV $GGUHVV
P2-04	Braking time before starting	0.0-50.0s	0.0s	Yes	●	40204
P2-05	Stop mode	0: Coast to stop 1: Ramp to stop 2: DC braking stop	1	Yes	●	40205
P2-06	Start frequency of DC braking	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	2.0 Hz	Yes	●	40206
P2-07	Braking current for stopping	0-150%	50%	Yes	●	40207
P2-08	Braking time for stopping	0.0-50.0s	0.0s	Yes	●	40208
P2-09	Demagnetizing time	0.0-30.0s	0.1s	Yes	●	40209
P2-10	Dead time between FWD/REV	0.0-50.0s	0.2s	Yes	●	40210
P2-11	Lower frequency limit crossing action	0: Running with low limit frequency 1: Stopping 2: Standby 3: Hibernation	0	Yes	●	40211
P2-12	Hibernation restore delay time	0-50.0s	0.0s	Yes	●	40212

3 0RWRU SDUDPHWHUV

)\; &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW %DVLF 9DOXH	0RGLI\ GXULQJ 6HWWLQJ	0RGLILFDWLRQ $WWULEXWH	0RGEXV $GGUHVV
P3-00	Rated frequency	0.0-400.0 Hz	50.0 Hz	Yes	●	40300
P3-01	Rated voltage	Depends on model	Depends on model	Yes	●	40301
P3-02	Rated current	Depends on model	Depends on model	Yes	●	40302
P3-03	Rated power	Depends on model	Depends on model	Yes	●	40303
P3-04	Rated speed	1-36000 RPM	1500	Yes	●	40304
P3-05	No. of poles	2-8	4	No	●	40305
P3-06	No load current	0.1 - Rated current (P3-02)	Depends on model	No	●	40306

3 6FDODU FRQWURO SDUDPHWHUV

)\; &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW %DVLF 9DOXH	0RGLI\ GXULQJ 6HWWLQJ	0RGLILFDWLRQ $WWULEXWH	0RGEXV $GGUHVV
P4-00	V/f curve setting	0: General V/f 1: 1.5 Power V/f 2: 1.7 Power V/f 3: 2 Power V/f 4: Multipoint V/f	0	Yes	●	40400
P4-01	V/f Intermediate frequency 1 (F1)	0.0 Hz - F2 (P4-03)	1.0 Hz	Yes	●	40401

Code	Description	Setting Range	Default Value	Modbus Address
P4-02	V/f intermediate voltage 1	0 - Rated voltage (P3-01)	5V	40402
P4-03	V/f Intermediate frequency 2 (F2)	F1 (P4-01)-F3 (P4-05)	5.0 Hz	40403
P4-04	V/f Intermediate frequency 2	0 - Rated voltage (P3-01)	25V	40404
P4-05	V/f Intermediate frequency 3 (F3)	F2 (P4-03) - Rated frequency (P3-00)	25.0 Hz	40405
P4-06	V/f Intermediate voltage 3	0 - Rated voltage (P3-01)	115V	40406
P4-07	Torque boost	0.0-25.0%	3.5%	40407
P4-08	AVR function	0: Disable 1: Always enable 2: Only enable during deceleration	1	40408
P4-09	Energy-efficient running (EER)	0: Disable 1: Enable	0	40409
P4-10	Braking unit enable	0: Disable 300-400: Enable level (1Ø) 600-700: Enable level (3Ø)	0	40410
P4-11	Slip compensation	0.00: Disable 0.01 to 10.00: Compensation factor	0.00	40411

3 ,QSXW IXQFWLRQ SDUDPHWHUV

Code	Description	Setting Range	Default Value	Modbus Address
P5-00	Lower limit of POT	0.0-100.0%	0.5%	40500
P5-01	Corresponding setting of POT lower limit	0.0-100.0%	0.0%	40501
P5-02	Upper limit of POT	Lower limit of POT (P5-00) – 100.0%	100.0%	40502
P5-03	Corresponding setting of POT upper limit	0.0 -100.0%	100.0%	40503
P5-04	POT input filtering time	0.0s -10.0s	0.1s	40504
P5-05	POT signal loss threshold	0.0 - Lower limit of POT (P5-00)	0.5%	40505
P5-06	Lower limit of AI	0.0-100.0 %	0.5%	40506
P5-07	Corresponding setting of AI lower limit	0.0-100.0 %	0.0%	40507
P5-08	Upper limit of AI	Lower limit of AI (P5-06) - 100.0%	100.0%	40508
P5-09	Corresponding setting of AI upper limit	0.0-100.0%	100.0%	40509

) ; & R G H	' H V F U L S W L R Q	6 H W W L Q J V D Q G 5 D Q J H	' H I D X O W 9 D O X H	% D V L F 6 H W W L Q J	0 R G L I L F D W L R Q	0 R G E X V $ G G U H V V
P5-10	AI input filtering time	0.0s-10.0s	0.1s	Yes	○	40510
P5-11	AI signal loss threshold	0.0 - Lower limit of AI (P5-06)	0.5%	Yes	○	40511
P5-12	PNP/NPN selection	0: NPN 1: PNP	1	Yes	●	40512
P5-13	Multifunction Input X1	0: Disable 1: Forward rotation 2: Reverse rotation 3: Three-wire control 4: Multiphase reference velocity 1 5: Multiphase reference velocity 2 6: Multiphase reference velocity 3 7: Multiphase reference velocity 4 8: Forward JOG 9: Reverse JOG 10: Increasing frequency 11: Decreasing frequency 12: Acc - Dec time option 1 13: Acc - Dec time option 2 14: Stop of Acc - Dec 15: External fault input 16: Fault reset 17: Regular stopping 18: External count value input 19: Count clear 20: Program run 21: Pause of program run 22: DC brake 23: E-Stop 24: Hand function (level triggered) 25: Hand function (rising edge triggered)	1	Yes	●	40513
P5-14	Multifunction Input X2		2	Yes	●	40514
P5-15	Multifunction Input X3		8	Yes	●	40515
P5-16	Multifunction Input X4		15	Yes	●	40516
P5-17	Multifunction Input X5		16	Yes	●	40517
P5-18	Multifunction Input X6		9	Yes	●	40518
P5-19	Multifunction Input X7		23	Yes	●	40519
P5-20	Multifunction Input X8		24	Yes	●	40520
P5-21	X1 On delay	0.0 - 999.9s	0.0s	No	●	40521
P5-22	X2 On delay	0.0 - 999.9s	0.0s	No	●	40522
P5-23	X3 On delay	0.0 - 999.9s	0.0s	No	●	40523
P5-24	X4 On delay	0.0 - 999.9s	0.0s	No	●	40524
P5-25	X5 On delay	0.0 - 999.9s	0.0s	No	●	40525
P5-26	X6 On delay	0.0 - 999.9s	0.0s	No	●	40526
P5-27	X7 On delay	0.0 - 999.9s	0.0s	No	●	40527
P5-28	X8 On delay	0.0 - 999.9s	0.0s	No	●	40528
P5-29	X1 Off delay	0.0 - 999.9s	0.0s	No	●	40529
P5-30	X2 Off delay	0.0 - 999.9s	0.0s	No	●	40530

P5-31	X3 Off delay	0.0 - 999.9s	0.0s	No	●	40531
P5-32	X4 Off delay	0.0 - 999.9s	0.0s	No	●	40532
P5-33	X5 Off delay	0.0 - 999.9s	0.0s	No	●	40533
P5-34	X6 Off delay	0.0 - 999.9s	0.0s	No	●	40534
P5-35	X7 Off delay	0.0 - 999.9s	0.0s	No	●	40535
P5-36	X8 Off delay	0.0 - 999.9s	0.0s	No	●	40536
P5-37	Input Off delay interruption	0 : Disable 1 : Enable	1	No	●	40537
P5-38	Terminal control mode	Stop at power on: 0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2 Auto - Run at power on: 4: Two-wire control mode 1 5: Two-wire control mode 2 6: Three-wire control mode 1 7: Three-wire control mode 2	0	Yes	●	40538
P5-39	Terminal filtering time	2-100ms	10ms	No	○	40539
P5-40	Terminal frequency updation step size	0.0-Upper limit of frequency (P0-09)	0.1 Hz	No	○	40540

3 2XWSXW IXQFWLRQ SDUDPHWHUV

)\; FRGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLI\	0RGEXV $GGUHVV
P6-00	Y1 output options	0: Disable 1: Running 2: Direction 3: Fault output 4: Pre-alarm 5: Standby 6: Frequency arrived 7: Frequency detected 8: Upper limit frequency 9: Lower limit frequency 10: Setting count value received 11: Specified count value Received 12: POT signal loss 13: AI signal loss 14: Dormancy detection 15. Hand detection 16. Running status (DO will be high till output freq. reaches zero)	1	Yes	○	40600
P6-01	Y2 output options		2	Yes	○	40601
P6-02	Relay1 output options		3	Yes	○	40602
P6-03	Relay2 output options		0	Yes	○	40603
P6-04	Y1 On delay	0.0 - 999.9s	0.0s	No	●	40604
P6-05	Y2 On delay	0.0 - 999.9s	0.0s	No	●	40605
P6-06	Y1 Off delay	0.0 - 999.9s	0.0s	No	●	40606
P6-07	Y2 Off delay	0.0 - 999.9s	0.0s	No	●	40607
P6-08	Relay1 On delay	0.0 - 999.9s	0.0s	No	●	40608

); &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLIL FDWLRQ	0RGEXV $GGUHVV
P6-09	Relay2 On delay	0.0 - 999.9s	0.0s	No	●	40609
P6-10	Relay1 Off delay	0.0 - 999.9s	0.0s	No	●	40610
P6-11	Relay2 Off delay	0.0 - 999.9s	0.0s	No	●	40611
P6-12	Output Off delay interruption	0: Disable 1: Enable	1	No	●	40612
P6-13	AO options	0: Operating frequency 1: Output current 2: Bus voltage 3: Output voltage 4: AI retransmission	0	Yes	○	40613
P6-14	AO correction coefficient	0.0 - 250.0%	100.0%	Yes	○	40614
P6-15	AO current range selection	0: 0~20mA; 1: 4~20mA	0	Yes	○	40615

3 3, &RQWURO SDUDPHWHUV

); &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLIL FDWLRQ	0RGEXV $GGUHVV
P7-00	PI reference source	0: Keyboard 1: Panel encoder 2: Analog channel POT	0	No	○	40700
P7-01	Display scaling high for PI values	P7-02 - 999.9	100.0	No	●	40701
P7-02	Display scaling low for PI values	0.0 - P7-01	0.0	No	●	40702
P7-03	PI Set values	P7-02 - P7-01	0.0	No	○	40703
P7-04	Feedback source	0: AI	0	No	○	40704
P7-05	PI output characteristics options	0: Positive 1: Negative	0	No	○	40705
P7-06	Proportional gain	0.0-10.0	1.0	No	○	40706
P7-07	Integral time	0.0-100.0s	1.0s	No	○	40707
P7-08	Deviation limit	0.0-20.0	2.0	No	○	40708
P7-09	Sampling time	0.1-100.0s	0.2s	No	○	40709
P7-10	Feedback disconnection value	0.1-50.0%	0.1%	No	○	40710
P7-11	Feedback disconnection detection time	0.1-100.0s	10.0s	No	○	40711
P7-12	Dormancy value	P7-02 - P7-01	0.0	No	○	40712
P7-13	Dormancy time	0.0s - 50.0s	0.0s	No	○	40713
P7-14	Wake up value	P7-02 - P7-01	0.0	No	○	40714
P7-15	Wake up time	0.0s - 50.0s	0.0s	No	○	40715

3 6LPSOH 3/& DQG 0XOWLVSHHG RSWLRQV

)XQF &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLILFDWLRQ	0RGEXV $GGUHVV
P8-00	Program run mode	0: Disable 1: Program stops after running for one cycle 2: Program runs for one cycle & then continues at last operating frequency 3: Circulatory running of the program	0	Yes	●	40800
P8-01	First phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	11.0 Hz	No	○	40801
P8-02	Second phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	12.0 Hz	No	○	40802
P8-03	Third phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	13.0 Hz	No	○	40803
P8-04	Fourth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	14.0 Hz	No	○	40804
P8-05	Fifth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	15.0 Hz	No	○	40805
P8-06	Sixth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	16.0 Hz	No	○	40806
P8-07	Seventh phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	17.0 Hz	No	○	40807
P8-08	Eighth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	18.0 Hz	No	○	40808
P8-09	Nineth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	19.0 Hz	No	○	40809
P8-10	Tenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	20.0 Hz	No	○	40810
P8-11	Eleventh phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	21.0 Hz	No	○	40811
P8-12	Twelveth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	22.0 Hz	No	○	40812
P8-13	Thirteenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	23.0 Hz	No	○	40813
P8-14	Fourteenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	24.0 Hz	No	○	40814
P8-15	Fifteenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	25.0 Hz	No	○	40815
P8-16	Runtime of principal frequency	0.0 - 6400.0	0.0	No	○	40816
P8-17	First phase time	0.0 - 6400.0	0.0	No	○	40817
P8-18	Second phase time	0.0 - 6400.0	0.0	No	○	40818
P8-19	Third phase time	0.0-6400.0	0.0	No	○	40819
P8-20	Fourth phase time	0.0-6400.0	0.0	No	○	40820
P8-21	Fifth phase time	0.0-6400.0	0.0	No	○	40821
P8-22	Sixth phase time	0.0-6400.0	0.0	No	○	40822
P8-23	Seventh phase time	0.0-6400.0	0.0	No	○	40823

)\; &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLILFDWLRQ	0RGEXV $GGUHVV
P8-24	Eighth phase time	0.0-6400.0	0.0	No	○	40824
P8-25	Nineth phase time	0.0-6400.0	0.0	No	○	40825
P8-26	Tenth phase time	0.0-6400.0	0.0	No	○	40826
P8-27	Eleventh phase time	0.0-6400.0	0.0	No	○	40827
P8-28	Twelveth phase time	0.0-6400.0	0.0	No	○	40828
P8-29	Thirteenth phase time	0.0-6400.0	0.0	No	○	40829
P8-30	Fourteenth phase time	0.0-6400.0	0.0	No	○	40830
P8-31	Fifteenth phase time	0.0-6400.0	0.0	No	○	40831
P8-32	Time unit of multi-velocity	0: Seconds; 1: Minutes 2: Hours	0	No	●	40832
P8-33	Running direction of programs	0-65535 BIT0-15 indicates directions for 0 -15 phase speeds (0:FWD 1:REV)	0	No	●	40833
P8-34	Acc-Dec Time1 for each phase	0-65535 BIT0-15 indicated acc/dec times for 0 - 7 phase speeds	0	No	○	40834
P8-35	Acc-Dec Time2 for each phase	0-65535 BIT0-15 indicated acc/dec times for 8 - 15 phase speeds	0	No	○	40835

3 3URWHFWLRQ SDUDPHWHUV

)\; &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLILFDWLRQ	0RGEXV $GGUHVV
P9-00	Overload protection enable	0: Disable; 1: Enable	1	Yes	●	40900
P9-01	Critical value of Overload protection	50-200%	150%	Yes	●	40901
P9-02	Overload detection time	0.1 - 3600.0s	60.0s	Yes	●	40902
P9-03	Overload pre -alarm enabled	0: Disable; 1: Enable	0	No	●	40903
P9-04	Overload pre-alarm detection level	50% to critical value of overload protection (P9-01)	95%	No	●	40904
P9-05	Overload pre-alarm detection time	0.1 - 3600.0s	60.0s	No	●	40905
P9-06	Overvoltage protection enable	0: Disable 1: Enable	1	Yes	●	40906
P9-07	Critical value of OV protection	1Ø: 220-275V 3Ø: 415-560V	1Ø: 265V 3Ø: 520V	Yes	●	40907
P9-08	Overvoltage trip time	0.1 - 3600.0s	3.0s	Yes	●	40908
P9-09	Overvoltage pre-alarm enable	0: Disable 1: Enable	0	No	●	40909
P9-10	Overvoltage pre-alarm detection level	1Ø: 220-(P9-07) 3Ø: 415-(P9-07)	1Ø: 245V 3Ø: 450V	No	●	40910
P9-11	Overvoltage pre-alarm detection time	0.1 - 3600.0s	3.0s	No	●	40911

)\; &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW %DVLF 9DOXH	0RGLI\ 6HWWLQJ	0RGEXV 3DWLRQ	0RGEXV $GGUHVV
P9-12	Under voltage protection enable	0: Disable; 1: Enable 2: Fault Auto-Reset	0	Yes	●	40912
P9-13	Critical value of Under-voltage protection	1Ø: 180-240V 3Ø: 315-415V	1Ø-195V 3Ø-350V	Yes	●	40913
P9-14	Undervoltage trip time	0.1 - 3600.0s	3.0s	Yes	●	40914
P9-15	Undervoltage pre-alarm enable	0: Disable; 1: Enable	0	No	●	40915
P9-16	Undervoltage pre-alarm detection level	1Ø: (P9-13)-240V 3Ø: (P9-13)-415V	1Ø: 200V 3Ø: 380V	No	●	40916
P9-17	Undervoltage pre-alarm detection time	0.1 - 3600.0s	3.0s	No	●	40917
P9-18	Overcurrent protection enable	0: Disable 1: Enable	1	Yes	●	40918
P9-19	Critical value of overcurrent protection	50-200%	150%	Yes	●	40919
P9-20	Overcurrent trip time	0.1 - 3600.0s	60.0s	Yes	●	40920
P9-21	Overcurrent pre-alarm enable	0: Disable 1: Enable	0	No	●	40921
P9-22	Overcurrent pre-alarm detection level	50% - P9-19	85%	No	●	40922
P9-23	Overcurrent pre-alarm detection time	0.1 - 3600.0s	60.0s	No	●	40923
P9-24	Undercurrent protection enable	0: Disable 1: Enable	0	Yes	●	40924
P9-25	Critical value of UC protection	20 - 90%	25%	Yes	●	40925
P9-26	UC trip time	0.1 - 3600.0s	5.0s	Yes	●	40926
P9-27	UC pre-alarm enable	0: Disable 1: Enable	0	No	●	40927
P9-28	UC pre-alarm detection level	P9-25 - 90%	50%	No	●	40928
P9-29	UC pre-alarm detection time	0.1 - 3600.0s	5.0s	No	●	40929
P9-30	Output single phasing protection	0: Disable 1: Enable	0	Yes	●	40930
P9-31	Low power actions	0: Coast; 1: Continue 2. Recovery	1	Yes	●	40931
P9-32	Automatic current limit	0: Disable 1: Enable	0	Yes	●	40932
P9-33	Automatic current limit level	50-180%	150%	No	●	40933

3)DXOW KLVWRU\

); &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW %DVLF 9DOXH	0RGLI\ 6HWWLQJ#	0RGEXV $GGUHVV
P10-00	Previous fault code	0-20	0	Yes	×	41000
P10-01	2nd to previous fault code	0-20	0	Yes	×	41001
P10-02	3rd to previous fault code	0-20	0	Yes	×	41002
P10-03	Previous fault operating frequency	-	-	No	×	41003
P10-04	Previous fault Current	-	-	No	×	41004
P10-05	Previous fault bus voltage	-	-	No	×	41005
P10-06	Previous fault input state	-	-	No	×	41006
P10-07	Previous fault output state	-	-	No	×	41007

3 &RPPXQLFDWLRQ SDUDPHWHUV

); &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW %DVLF 9DOXH	0RGLI\ 6HWWLQJ#	0RGEXV $GGUHVV
P11-00	Slave address	1-127 (0 for broadcast address)	1	Yes	●	41100
P11-01	Communication baud rate	0: 1200; 1: 2400; 2: 4800; 3: 9600; 4: 19200; 5: 38400; 6: 57600; 7: 115200	3	Yes	●	41101
P11-02	Modbus data format	0: 8-N-1; 1: 8-N-2; 2: 8-E-1 3: 8-E-2; 4: 8-O-1; 5: 8-O-2	0	Yes	●	41102
P11-03	Response delay	0-200ms	20ms	No	●	41103
P11-04	Serial timeout	0: Disable; 1: Time setting	0	No	●	41104
P11-05	Serial timeout time setting	0.1-60.0s	5.0s	No	●	41105
P11-06	Abnormal action selection	0: Warn & Continue operation 1: Continue operation without warning 2: Alarm shutdown (Coast to Stop) 3: Alarm shutdown (Ramp to Stop)	0	No	●	41106

3 (QKDQFHG SDUDPHWHUV

); &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW %DVLF 9DOXH	0RGLI\ 6HWWLQJ#	0RGEXV $GGUHVV
P12-00	Acc. time 1	0.1-3600.0s	20.0s	No	○	41200
P12-01	Dec. time 1	0.1-3600.0s	20.0s	No	○	41201
P12-02	Acc. time 2	0.1-3600.0s	20.0s	No	○	41202
P12-03	Dec. time 2	0.1-3600.0s	20.0s	No	○	41203
P12-04	Acc. time 3	0.1-3600.0s	20.0s	No	○	41204
P12-05	Dec. time 3	0.1-3600.0s	20.0s	No	○	41205

)\; &RGH	'HVFULSWLRQ	6HWWLQJV DQG 5DQJH	'HIDXOW 9DOXH	%DVLF 6HWWLQJ	0RGLILFDWLRQ	0RGEXV $GGUHVV
P12-06	Jog Acc. time	0.1-3600.0s	5.0s	No	○	41206
P12-07	Jog Dec. time	0.1-3600.0s	5.0s	No	○	41207
P12-08	Hopping frequency 1 lower limit	Lower limit frequency (P0-10) - Hopping frequency 1 upper limit (P12-09)	0.0 Hz	No	○	41208
P12-09	Hopping frequency 1 upper limit	Hopping frequency 1 lower limit (P12-08) - Upper limit frequency (P0-09)	0.0 Hz	No	○	41209
P12-10	Hopping frequency 2 lower limit	Lower limit frequency (P0-10) - Hopping frequency 2 upper limit (P12-11)	0.0 Hz	No	○	41210
P12-11	Hopping frequency 2 upper limit	Hopping frequency 2 lower limit (P12-10) - Upper limit frequency (P0-09)	0.0 Hz	No	○	41211
P12-12	FDT level detection value	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.0 Hz	No	○	41212
P12-13	FDT level lagged value	Lower limiting frequency (P0-10) - FDT Level detection value (P12-12)	0.0 Hz	No	○	41213
P12-14	Amplitude of frequency arrival	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.0 Hz	No	○	41214
P12-15	Setting count	1-65535	10	No	○	41215
P12-16	Specific count	1 - Setting count (P12-15)	10	No	○	41216
P12-17	Fan control	0: Always on 1: VFD run linked 2: Temperature dependent	1	No	●	41217
P12-18	DSP code version	-	-	No	×	30057
P12-19	IO code version	-	-	No	×	30056
P12-20	HMI code version	-	-	No	×	30055
P12-21	HMI bootloader version	-	-	No	×	
P12-22	Manufacturing code (YY / MM)	-	-	No	×	41600

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	Parameter setting mode	0: Display only basic parameters 1: Display all settable parameters 2: Disable parameter settings 3: Factory reset	0

For ease of use, the entire parameter list has been divided into advanced and basic functions. When the setting is 0. only these basic parameters are visible and available for editing. When the setting is 1. all settable parameters are visible and available for editing. When the setting is 2. all parameters are visible, but they cannot be edited. Use this setting post-commissioning to protect accidental updating of parameters. The last setting, 3. will reset the drive to its default factory settings.

	Frequency setting mode	0: Keypad UP / DOWN keys 1: Panel encoder 2: External POT 3: External AI 4: PI regulation 5: Terminal setting using step size 6: Terminal setting using step size set frequency 0Hz after stop 7: Communication	1

This setting determines the source of setting frequency that will be considered by the drive for all operations. The explanations are as under-

0: The keypad Up/Down keys are used for manipulating the set frequency. Long pressing either will increase the rate.

1: The panel encoder is used for manipulating the set frequency. Steady, continuous rotation will increase the update rate at which the set frequency value gets updated.

2: External POT uses the POT terminal for manipulating the set frequency.

3: External AI uses the user-selectable Analogue input for updating the set frequency.

4: Set Frequency is manipulated using the inbuilt PI regulator.

5: Set Frequency is updated using the multifunction input terminals.

6: Set frequency is updated using the multifunction input terminals just like in setting 5 the only difference is that once the user stops the drive, the set frequency will shift to 0.0 Hz.

7: The user can use the external communication feature to update the set frequency

	Control mode for running	0: Controlled by keyboard 1: Controlled by terminal & stop key disabled 2: Controlled by terminal & stop key enabled 3: Controlled by communication	0

This setting determines the source of control signals for the drive.
For setting 0, the keypad RUN, JOG and STOP keys will control the operation.
For setting 1, the drive will be controlled by the multifunction terminals. The keypad STOP key will be disabled in this case.
In setting 2, the drive will still be controlled by the multifunction terminals. However, the STOP key on the keypad will be enabled and can be used to stop the drive's operation.
In setting 3, the drive operation will be controlled over external communication.

	Frequency setting	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	50.0 Hz

This function reflects the set frequency. When using external communication, this parameter needs to be updated for updating the drive's set frequency.

	Acc. time 0	0.1 - 3600.0s	20.0s
	Dec. time 0	0.1 - 3600.0s	20.0s

Acceleration and Deceleration times are defined as the time the drive will take to accelerate from 0.0Hz to Max Running Frequency (P0-08) and from Max Running Frequency (P0-08) to 0.0 Hz respectively. For intermediate frequencies, the acceleration and deceleration times will vary accordingly.

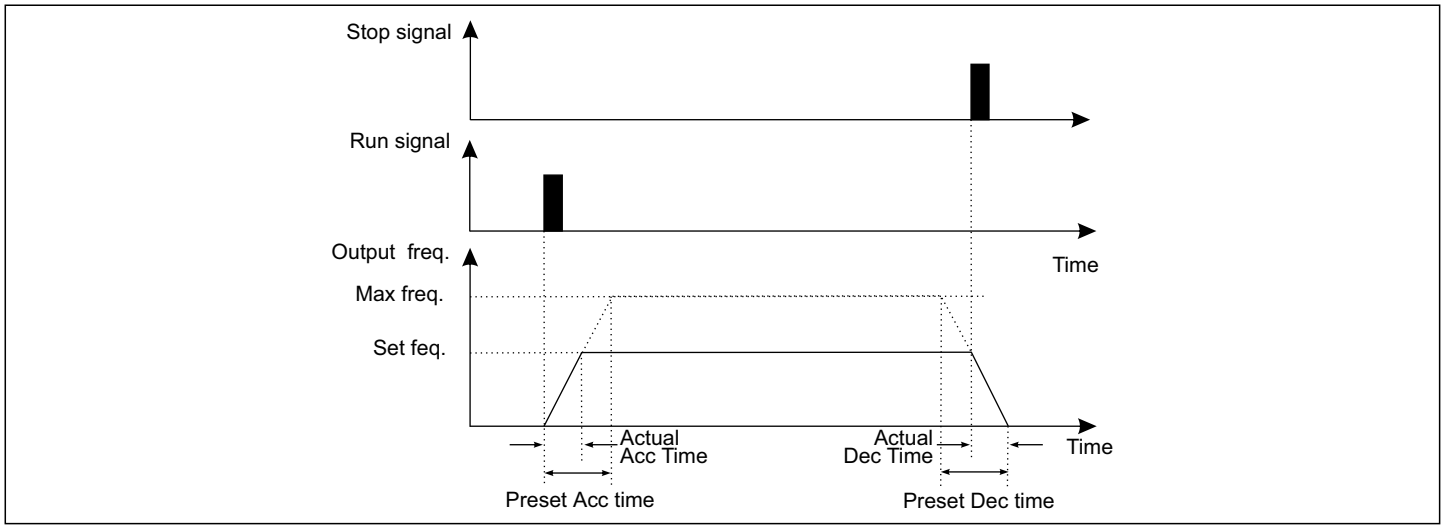

Fig.6.1 Acceleration and Deceleration

	Default running direction	0: Standard direction 1: Reverse direction	0

This parameter is used to determine the default running direction of the drive. It is useful when there is a need to permanently change the default direction of the motor. It helps the user as they do not need to manipulate the wiring to change the default direction. The direction chosen here will be treated as FORWARD (FWD) for all drive operations.

	Anti-reversion setting	0: Disable 1: Enable	0

This setting determines if the reverse operation will be allowed. If enabled, the drive will only allow operation in the FWD direction as determined through the setting of P0-06. Any attempt to operate the drive in the reverse direction through the keypad, terminals, communication, etc. will cause the drive to stop if it is running, or be ignored if it is not running.

	Max frequency	Upper limiting frequency (P0-09) - 400.0 Hz	60.0 Hz

This setting determines the maximum running frequency of the drive. Its primary use is to define the acceleration and deceleration times of the system.

	Upper limiting frequency	Lower limiting frequency (P0-10) - Max frequency (P0-08)	50.0 Hz
	Lower limiting frequency	0.0Hz - Upper limiting frequency (P0-09)	0.0 Hz

These settings determine the bounds of frequency within which the drive will operate. These values are also tied to the corresponding settings of the analogue input channels.

	Jog frequency	0.0Hz - Upper limiting frequency (P0-09)	5.0 Hz

This setting determines the set frequency in case of jog operation. This operation can be activated either through the keypad, terminals, or communication. Jogging refers to the controlled action of the drive used as a fine adjuster. The action is valid till the jogging signal is valid through the relevant control source.

[redacted]	Carrier frequency	Depends on model	Depends on model

The carrier frequency determines the switching frequency of the IGBTs used in the Inverter section of the drive. Audible noise and heat generated in the drive are directly affected by the carrier frequency. Higher carrier frequency will reduce the acoustic noise generated by the motor. However, it increases switching losses which result in higher heating of the unit and wastage of energy. In cases where the ambient temperature is too high or in systems that run at higher loads, a lower carrier frequency is suggested to improve the performance of the drive. Kindly note that a higher carrier frequency effectively impedes the heavy load performance of the drive. The factory default carrier frequency is set as per our calculations for the optimum performance of the drive. Unless absolutely demanded by the application at hand, it doesn't need any modifications or changes. In cases where a significantly higher carrier frequency is being used compared to the factory default value, some derating might be necessary.

[redacted]	Auto storage of keyboard frequency in case of power down	0: Retention after power down 1: No retention on power down	1

This function determines if the frequency set using the keyboard encoder or UP/DOWN keys will be retained post power down.

[redacted]	Default frequency for non-retention	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	50.0 Hz

This function determines the predetermined operational frequency that the VFD will automatically revert to upon power loss or after a system reset. To enable this, parameter P0-13 should be set to 1.

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[redacted]	Default startup display parameter	0: Set frequency 1: Output frequency 2: Output current 3: Bus voltage 4: Rotational speed of motor 5: IGBT temperature 6: Output voltage 7: Output power 8: Percentage of output current 9: Linear speed 10: Count value 11: PI index value (PI set value) 12: PI feedback value 13: Input terminal status 14: Output terminal status 15: Rated power	0

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WR VKLIW WR DIWHU WKH UXQ LV VWRSSHG

/(' &KDUDFWHU	'HVFULSWLRQ
[redacted]	Set frequency
[redacted]	Output frequency
[redacted]	Output current
[redacted]	Bus voltage
[redacted]	Rotational speed of motor
[redacted]	IGBT temperature
[redacted]	Output voltage
[redacted]	Output power

/(' &KDUDFWHU	'HVFULSWLRQ
[redacted]	Percentage of output current
[redacted]	Linear speed
[redacted]	Count value
[redacted]	PI index value (PI set value)
[redacted]	PI Feedback value
[redacted]	Input terminal status
[redacted]	Output terminal status
[redacted]	Rated power

	Runtime display parameters	Same as for P1-00	1

This option allows user to select one of the parameters provided in options to display when the drive is in running condition. At an initial condition, if the display is showing any page then after pressing the run key the display will return back to the selected option and will show that parameter over the display.

	Selection of display information	Count from 0 to 15 as given in P1-00	4

This determines the number of pages that will be shown in the online display pages. The count ID relates to the field ID as shared in P1-00.

	Display co-efficient of frequency	0.01-99.99	1.00

This parameter determines the multiplier that will be applied to the set & output frequency parameter being displayed on the keypad.

	Display co-efficient of mechanical speed	1.0-25.0	1.0

This parameter determines the multiplier that will be applied to the rotational speed field being displayed on the keypad and accessed through external communication.

	Display co-efficient of linear speed	0.001-9.999	1.000

This parameter determines the multiplier that will be applied to the rotational speed to calculate the linear speed being displayed on the keypad and accessed through external communication.

	Jog/Rev function selection	0: Jog; 1: FWD/REV switching	0

This function determines the role of the JOG/REV key on the keypad.

0-The JOG/REV key will initiate jogging action. As mentioned earlier, the jogging operation is only valid for as long as the jogging signal is present. In this case, the jogging action will only be valid for as long as the key has been pressed.

1-The JOG/REV key will act as a direction reverser. For it to work properly, the anti-reversion setting (P0-07) needs to be disabled.

Pressing the key will alternate the direction of rotation of the motor from FWD to REV and vice-versa.

This will be indicated to the user using the F/R LED on the keypad. Please note that the FWD direction will correspond to the default direction selected in the P0-06 setting.

	Password	0: Disable; 1: Enable	0
	Set password	1-9999	1

The password feature can be used to lock access to the programming parameters to prevent unauthorized changes. The password is required only when parameters are modified through the keypad, not via external communication.

	Frequency switch source	0: Keypad UP / DOWN keys 1: Keypad encoder 2: POT (potentiometer input) 3: AI (analog input) 4: Terminal setting step size 5: Communication	0
	Reference frequency	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.0 Hz

The user is given the option to switch between 2 frequency sources. This can be done by triggering the hand function by either using the HAND key on the HMI or the HAND function in the multifunction inputs. In case the value of P1-09 is stored as 0 or 1, the drive will switch to the frequency stored in P1-10.

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	Start mode	0: Direct start; 1: DC Braking start	0

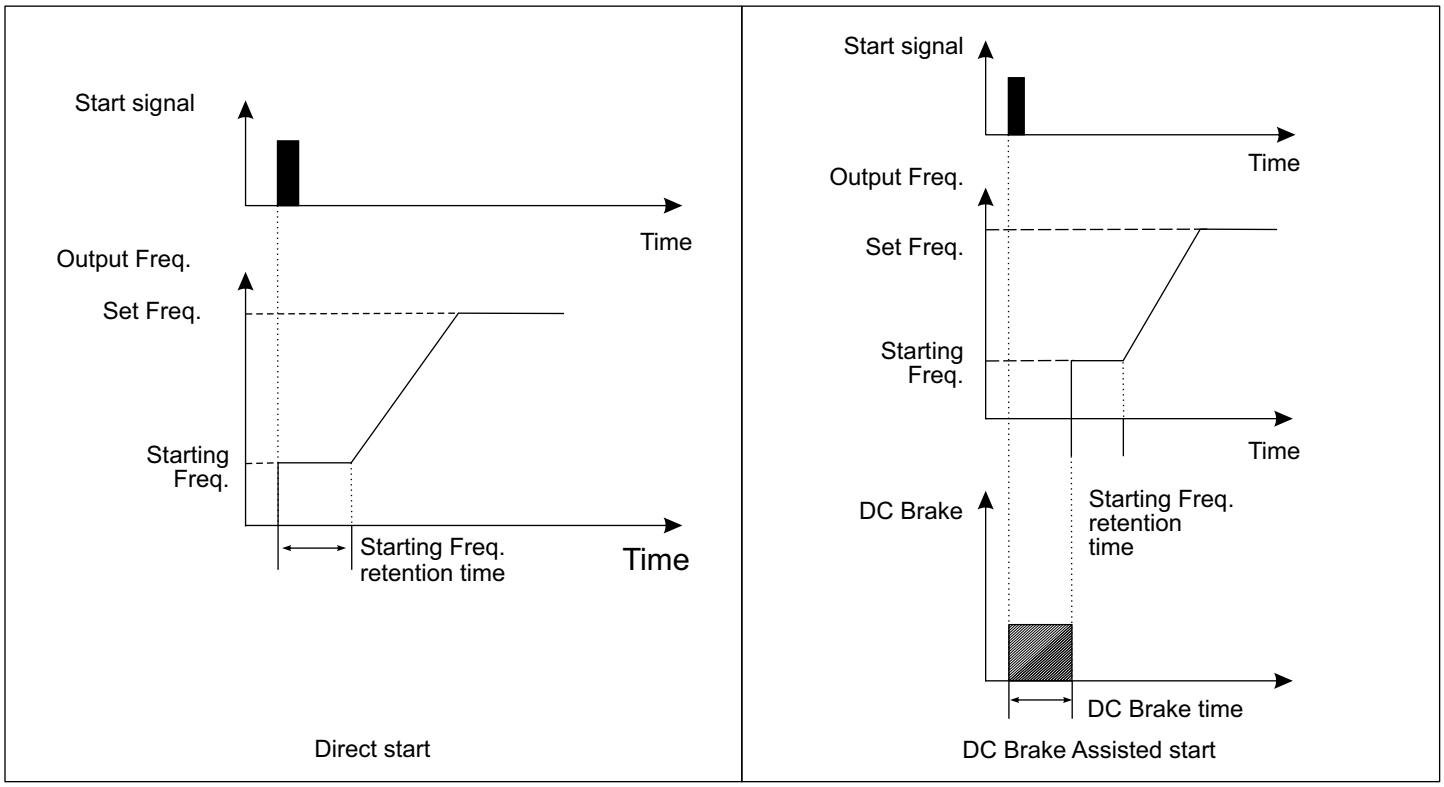

Fig.6.2 Direct Start and DC Brake Assisted Start

The start mode determines how the drive will initiate its operation when the RUN command is given through the selected control source.
0-In the direct start mode, the drive will start its operation towards the set frequency value directly.
1-In the DC Braking start mode, the drive will first inject a DC Current into the motor to hold it in place. This will be followed by the running operation towards set frequency. This technique is used in conditions where the load's inertia can cause the motor to operate in the reverse direction during startup.

	Starting frequency	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.5 Hz
	Retention time for starting	0.0-50.0s	0.0s

Applicable starting frequency can ensure that there is enough torque for starting. Retention time for starting is needed for the formation of magnetic flow while the motor is on standby so that it can start accelerating after the start frequency is stabilized for a certain time.

	Braking current before starting	0-150%	50%
	Braking time before starting	0.0-50.0s	0.0s

The braking current, expressed as a percentage of the rated current, determines the magnitude of the DC injection current used during startup. The duration for which this current is applied is set by parameter P2-04.

	Stop mode	0: Coast to Stop 1: Ramp to Stop 2: DC braking stop	1

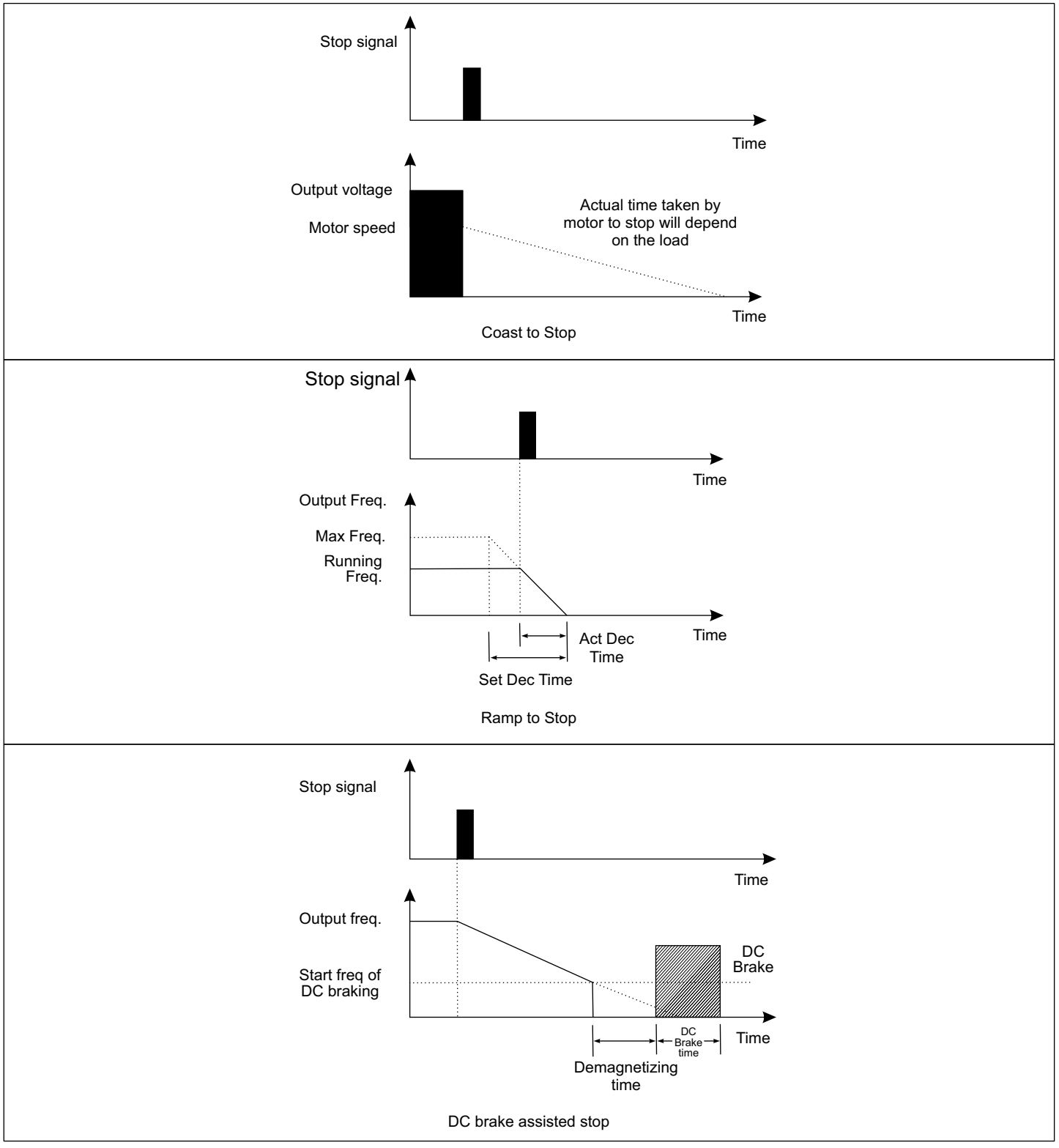

Fig.6.3 Different types of stop modes

This parameter determines how the drive executes the stopping operation

0: In coast to stop, the drive simply turns off all the output switches and the system comes to a halt purely based on the losses incurred due to friction

1: In the ramp to stop mode, the drive decelerates the motor as per the selected deceleration time

2: In DC Braking Stop, the drive first decelerates the motor to a preset frequency using the applicable deceleration time. This is followed by a demagnetization period and the injection of a settable DC current

	Start frequency of DC braking	Lower limiting frequency (P0-10)- Upper limiting frequency (P0-09)	2.0 Hz

This parameter determines the frequency at which the ramp deceleration operation ends and DC braking operation starts.

	Braking current for stopping	0-150%	50%
	Braking time for stopping	0.0-50.0s	0.0s

Similar to starting operation, the braking current for stopping is expressed as a percentage of the motor rated current and determines the magnitude of the braking current that will be injected into the motor during stopping. The P2-08 parameter determines the duration for which this current is applied.

	Demagnetizing time	0.0-30.0s	0.1s

Before applying the braking current, in high inertia loads, it becomes important to allow the motor to demagnetize itself. This is done to protect the motor from drawing excessive amounts of current and damaging itself. The duration specified here is applicable post the drive has reached the P2-06 frequency and before the DC injection current is applied.

	Deadtime between FWD/REV	0.0-50.0s	0.2s

This parameter determines the transient time for which the drive will be at 0.0Hz when switching direction.

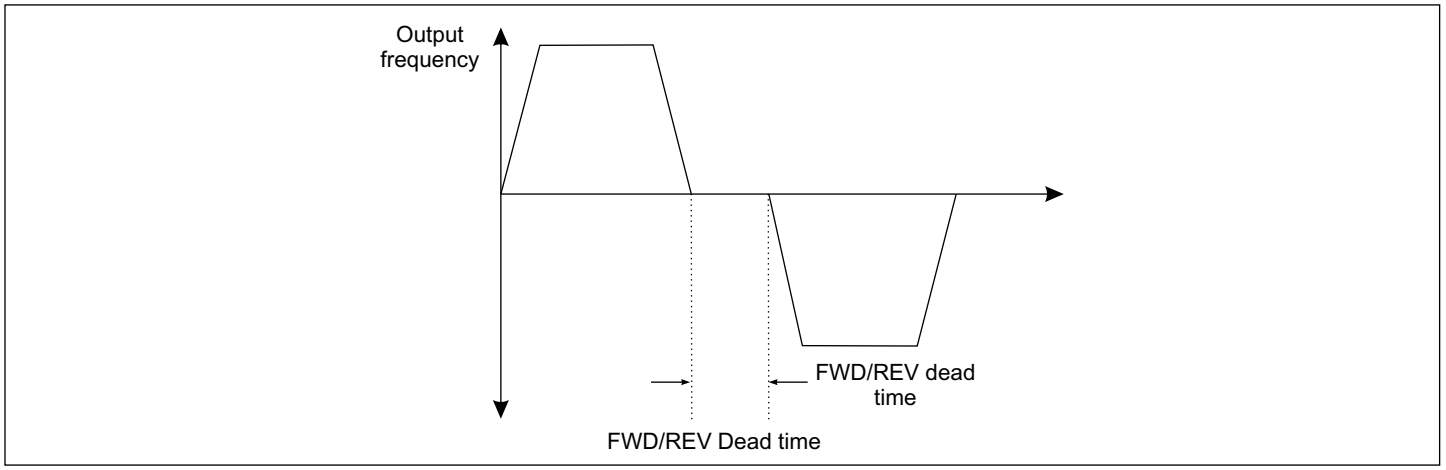

Fig.6.4 Dead time

	Lower frequency limit crossing action	0: Running with low Limit Frequency 1: Stopping 2: Standby 3: Hibernation	0
	Hibernation restore delay time	0.0-50.0s	0.0s

This setting determines the drive's operation when the set frequency, controlled via a potentiometer or analog input, falls below the lower limiting frequency defined in P0-10. In such cases, the drive can exhibit lower frequency limit crossing actions.

0: The drive continues running with Lower Limiting frequency as the set Frequency

1: The drive initiates stopping action

2: The drive enters standby mode. Here, the drive output remains in OFF condition till the set frequency goes above the lower limiting frequency

3: The drive enters hibernation mode. This is similar to standby mode as the drive turns all output switches OFF. However, to get out of hibernation, the set frequency needs to be above the lower limiting frequency for a user settable duration as determined in the parameter P2-12

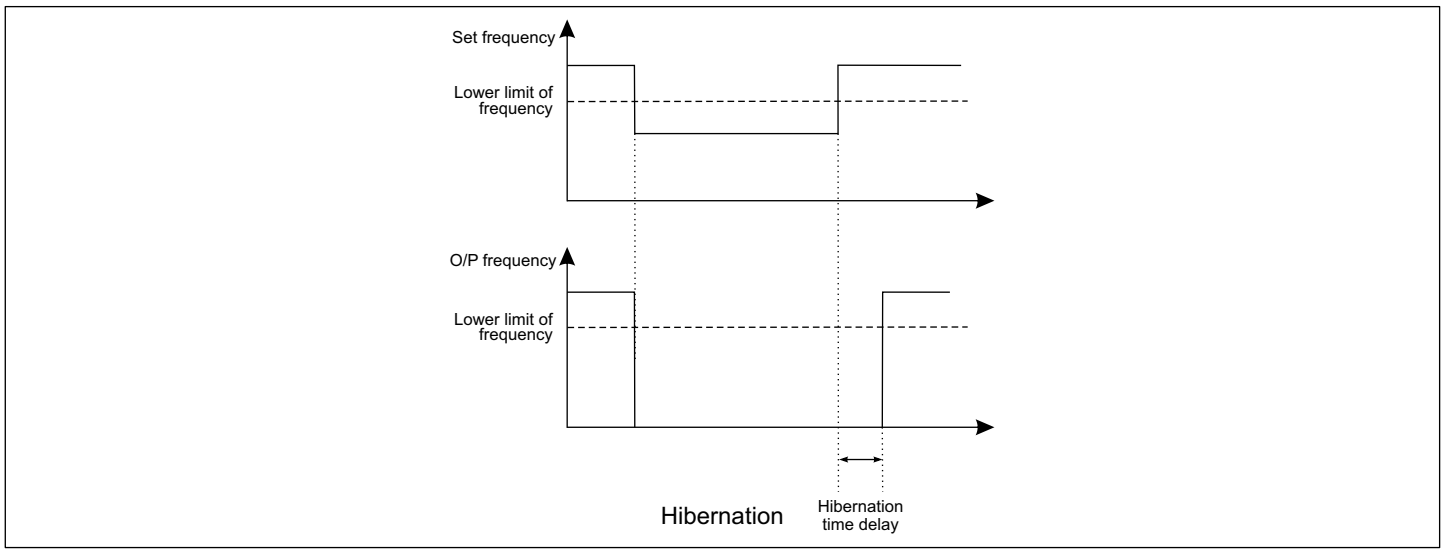

Fig.6.5 Hibernation

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[redacted]	Rated frequency	0.0-400.0 Hz	50.0 Hz
	Rated voltage	Depends on model	Depends on model
	Rated current	Depends on model	Depends on model
	Rated power	Depends on model	Depends on model
	Rated speed	1-36000 RPM	1500
	No. of poles	2-8	4
	No load current	0.1 - Rated current (P3-02)	Depends on model

The motor parameters are used for all protection and control calculations. These must reflect the actual motor nameplate data for proper operation of the entire system. Incorrectness in this data can hamper the efficiency and safety of the system as a whole.

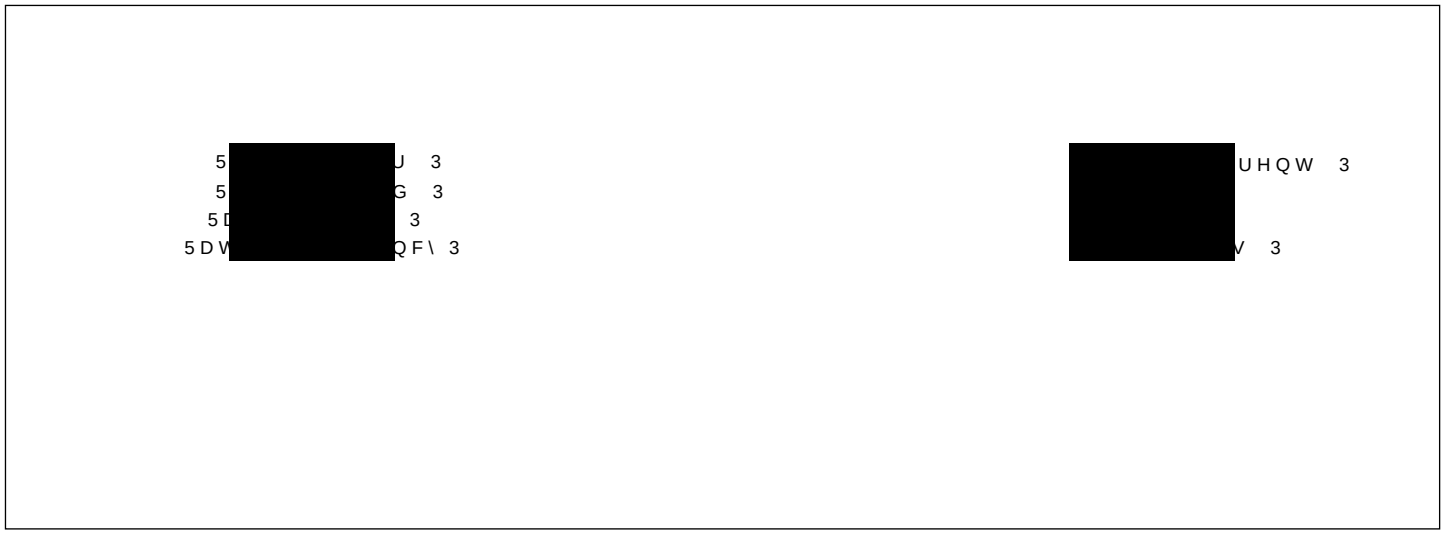

Fig.6.6 Motor parameters

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	V/f curve setting	0: General V/f 1: 1.5 Power V/f 2: 1.7 Power V/f 3: 2 Power V/f 4: Multipoint V/f	0

The V/f curve setting determines the profile of the V/f ratio that will be followed in the scalar operation of the drive.
In other words, it defines the nature of variation of the output voltage to the output frequency.

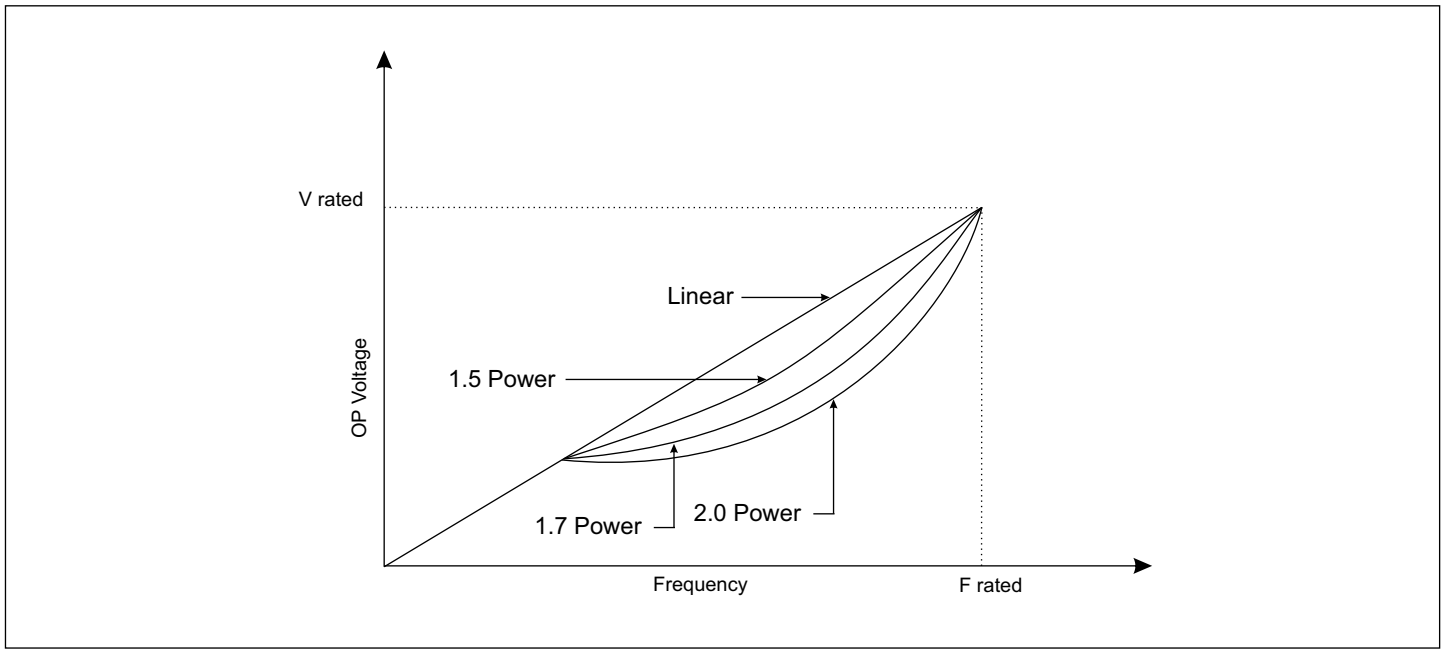

Fig.6.7 V/f curve settings

0: General V/f traces a linear relationship between the output voltage and frequency. It is used generally for constant load applications

1, 2, and 3: The Non-linear curves are usually used in pump and centrifugal applications and help in improving the energy efficiency of the system.

4: Multipoint V/f offers the user the option of entering a custom V/f curve using the rated Voltage and Frequency values and the user settable intermediate points in parameters P4-01 to P4-06.

	V/f Intermediate frequency 1 (F1)	0.0 Hz - F2 (P4-03)	1.0 Hz
	V/f intermediate voltage 1	0 - Rated voltage (P3-01)	5V
	V/f intermediate frequency 2(F2)	F1 (P4-01) - F3 (P4-05)	5.0 Hz
	V/f intermediate voltage 2	0 - Rated voltage (P3-01)	25V
	V/F intermediate frequency 3(F3)	F2 (P4-03) - Rated frequency (P3-00)	25.0 Hz
	V/F intermediate voltage 3	0 - Rated voltage (P3-01)	115V

These parameters are used to provide the user with the option of a customizable V/f curve that will best suit their application. These parameters are used only when P4-00 is set to 4 i.e. Multipoint V/f.

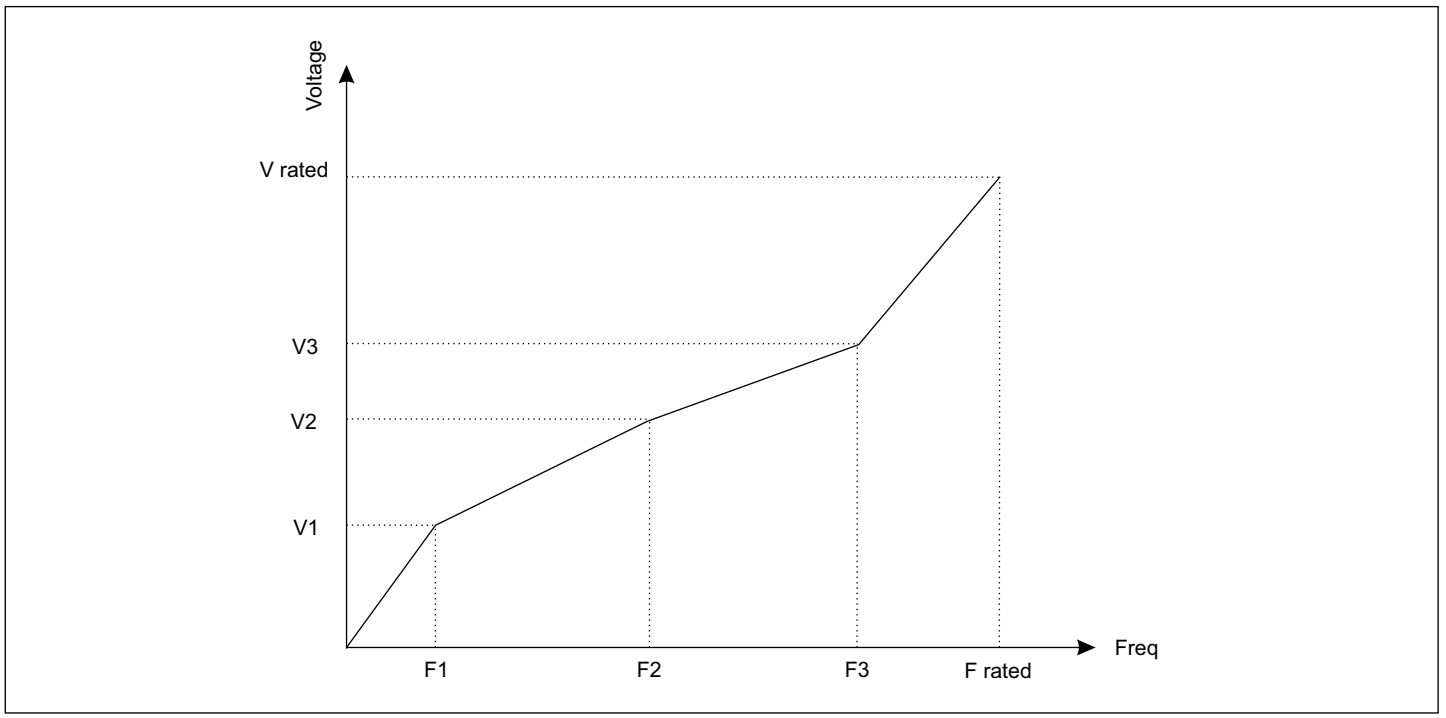

Fig.6.8 Multipoint V/f

	Torque boost	0 - 25.0%	3.5%

This parameter compensates for output voltage when the converter is running in the low-frequency region, to improve the low-frequency torque which is usually a drawback in scalar control schemes. However, if the setting of torque boost is too high, the motor could overheat or experience an overcurrent condition.
In general, the torque boost setting should not exceed 10%. Increase this parameter for heavy loads and decrease it otherwise.

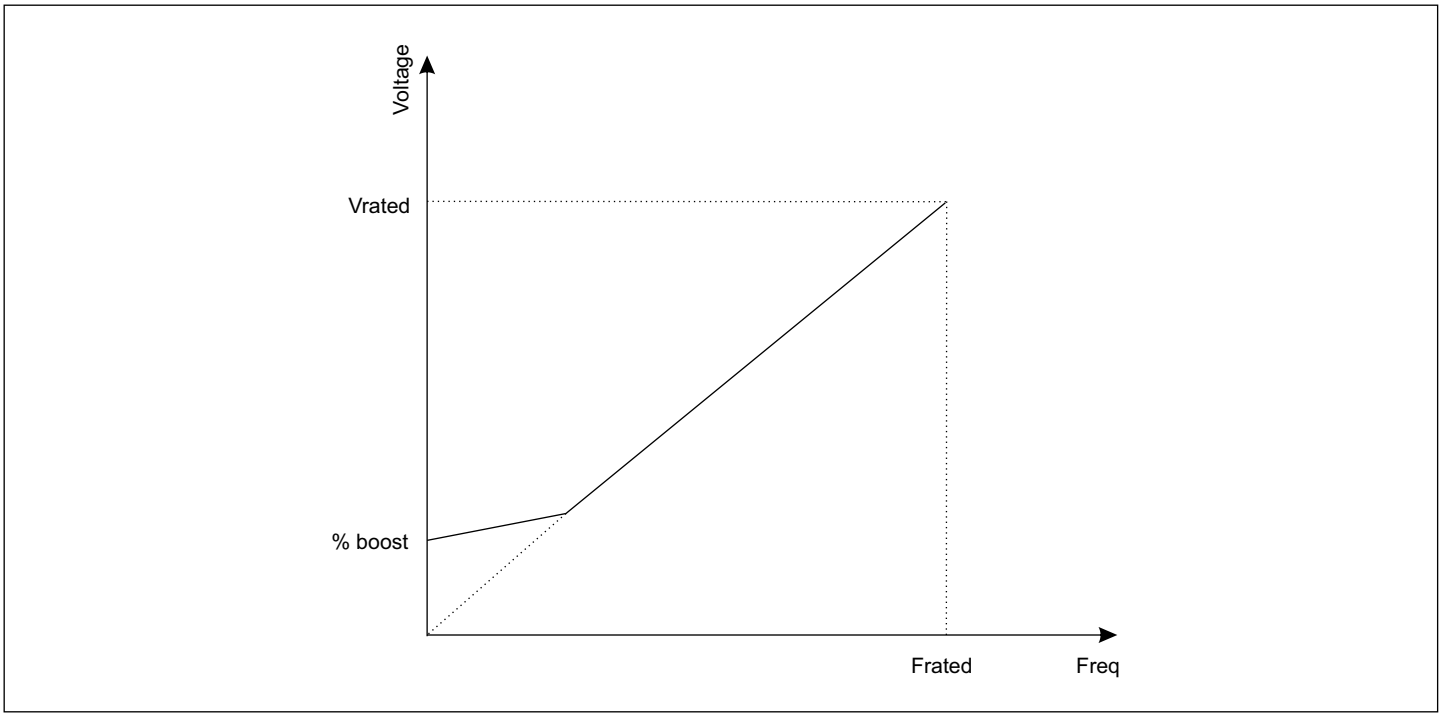

Fig.6.9 Torque boost

	AVR function	0: Disable 1: Always enable 2: Only enable during deceleration	1

The AVR (Automatic voltage regulation) function ensures that the output voltage of the drive remains stable even when the system experiences fluctuations in the grid voltage.

	Energy-efficient running (EER)	0: Disable 1: Enable	0

In no-load and low-load conditions, the EER option helps in reducing the energy consumed by the motor by controlling the output voltage accordingly.

	Braking unit enable	0: Disable 300-400: Enable (1Ø); 600-700: Enable (3Ø)	0

This parameter sets the DC Bus voltage reading value at which the internal braking unit is activated.

	Slip compensation	0.00: Disable 0.01 to 10.00: Compensation factor	0.0

Slip Compensation determines the compensation in the speed of motor when run on loaded condition.Due to the load, the speed of the motor can decrease which results in the increment of slip. Hence, in the motor operations where the accuracy in the speed is required, normal run mode can fail to meet the demand. Slip compensation mode is utilized to minimize the slip of motor and to maintain the accuracy in output speed. The compensation factor determines robustness of the compensation. Compensation factor may have to be tuned according to the loading conditions on the motor. Motor parameters need to be entered correctly for slip compensation to work.

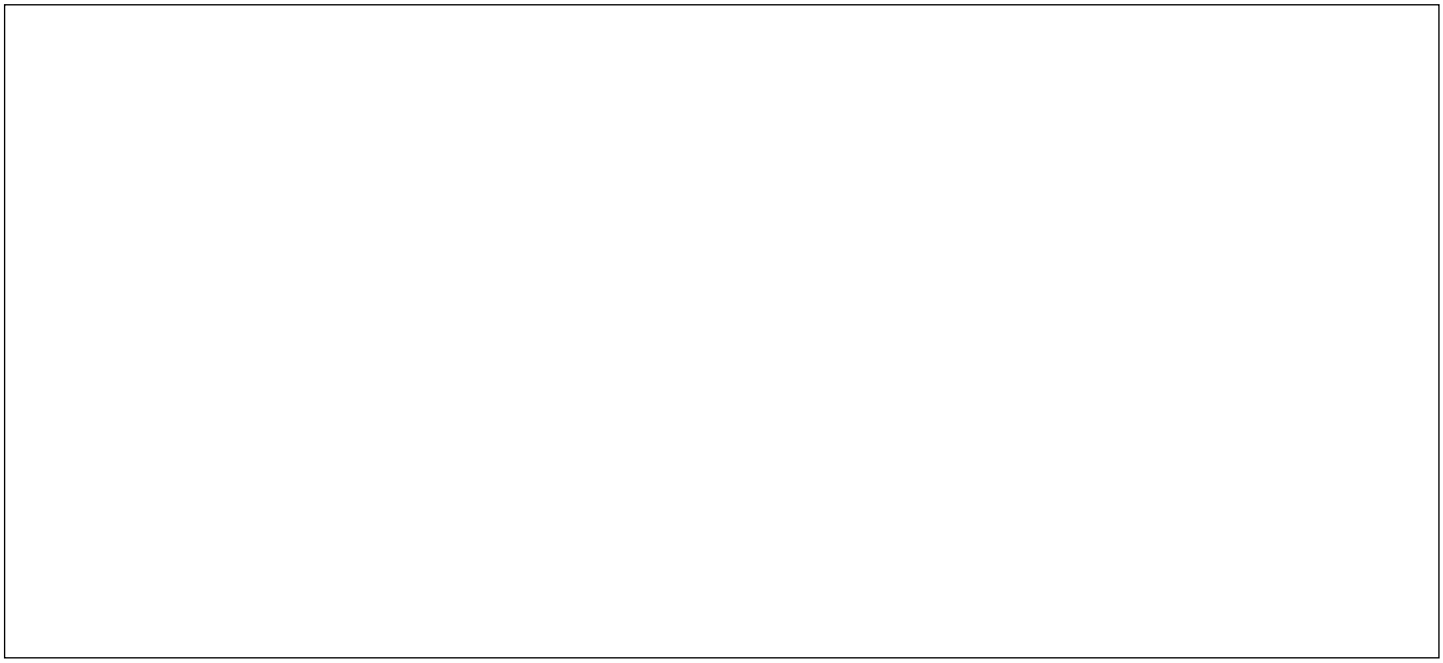

Fig.6.10 Slip compensation

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	Lower limit of POT	0.0-100.0%	0.5%
	Corresponding setting of POT lower limit	0.0-100.0%	0.0%
	Upper limit of POT	Lower limit of POT (P5-00) – 100.0%	100.0%
	Corresponding setting of POT upper limit	0.0-100.0%	100.0%
	POT input filtering time	0.0s-10.0s	0.1s
	POT signal loss threshold	0.0 to POT lower limit	0.5%

The functional codes above define the relationship between the analogue input signal and the corresponding variation in the set frequency value. These parameters relate specifically to the POT terminal. The P5-00 and P5-02 parameters define the percentage of the input signal that will be treated as the lower and upper limits for the signal received on the POT pin. The P5-01 and P5-03 parameters on the other hand are the corresponding limits for the set frequency values that will be mapped to the input signal. Note that P5-01 and P5-03 are defined as percentages of the Upper Limit Frequency as defined in P0-09. The relation between the AI signal and the corresponding signal has been explained in the graph below. The signal loss threshold denotes the level below which the system will consider the AI signal to be lost.

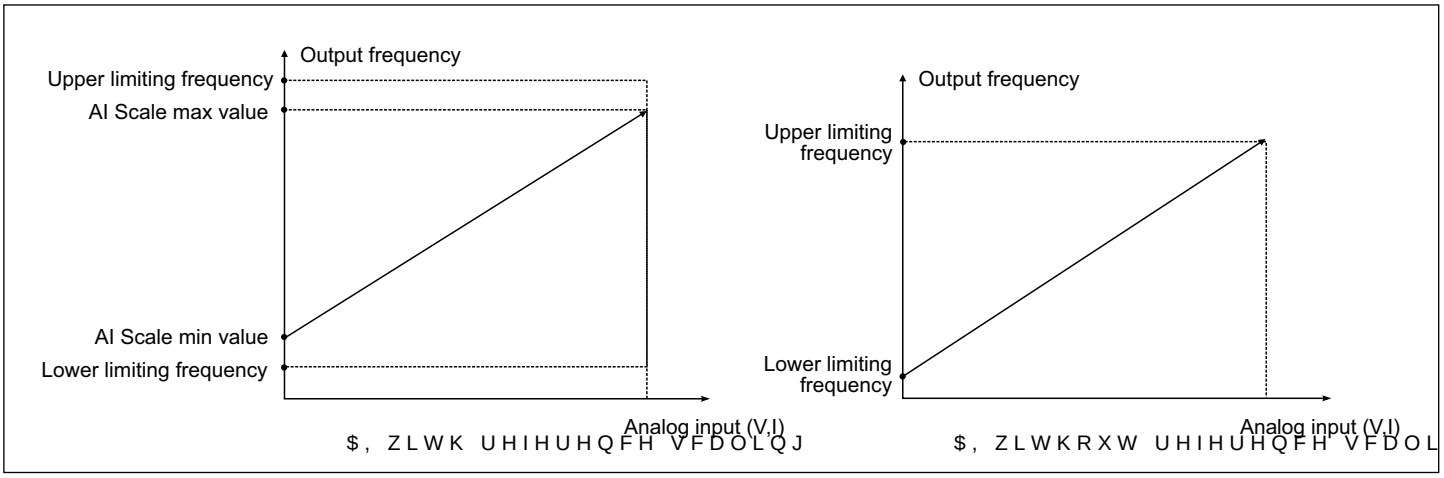

Fig.6.11 AI with and without scaling

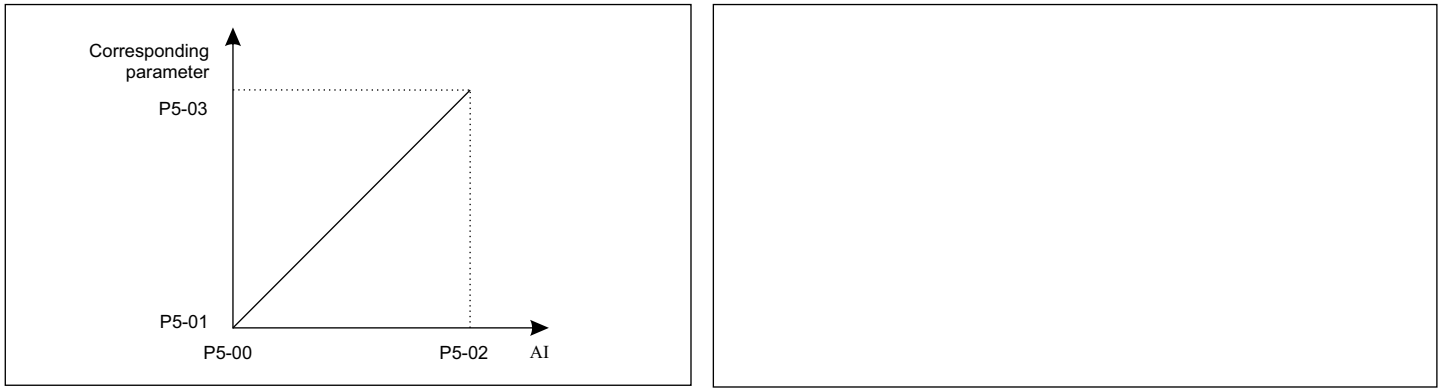

Fig.6.12 AI with and without filtering

	Lower limit of AI	0.0-100.0%	0.5%
	Corresponding setting of AI lower limit	0.0-100.0%	0.0%
	Upper limit of AI	Lower limit of AI (P5-06)-100.0%	100%
	Corresponding setting of AI upper limit	0.0-100.0%	100.0%
	AI input filtering time	0.0s-10.0s	0.1s
	AI signal loss threshold	0.0 to AI lower limit	0.5%

Similar to the previous parameters, these parameters relate to the AI terminal. Note that this is a user-selected V/I terminal where the user has the option of selecting if they wish to give voltage or current signals by altering the position of the AI switch.

	PNP/NPN Selection	0: NPN; 1: PNP	1

The P5-12 parameter is used to switch the polarity of the switches. Please refer to the standard wiring diagram for better clarity.

	Multifunction input X1	0 : Disable 1 : Forward rotation 2 : Reverse rotation 3 : Three - wire control 4 : Multiphase reference velocity 1 5 : Multiphase reference velocity 2 6 : Multiphase reference velocity 3 7 : Multiphase reference velocity 4 8 : Forward JOG 9 : Reverse JOG 10 : Increasing frequency 11 : Decreasing frequency 12 : Acc- Dec time option 1 13 : Acc - Dec time option 2 14 : Stop of Acc - Dec 15 : External fault input 16 : Fault reset 17 : Regular stopping 18 : External count value input 19 : Count clear 20 : Program run 21 : Pause of program run 22 : DC Brake 23 : E - Stop 24 : Hand function	1
	Multifunction input X2		2
	Multifunction input X3		8
	Multifunction input X4		15
	Multifunction input X5		16
	Multifunction input X6		9
	Multifunction input X7		23
	Multifunction input X8		24

These parameters allow the user to configure the functions for the multifunction inputs from X1 to X5. The functions are explained in the table below

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0	Disabled	The input is assigned no function. Use this to check your wiring as the inputs will still be detected in the HMI page and communication address. It is advised that all unused pins are disabled to prevent any unwanted actions from taking place accidentally.
1	Forward	Use these settings while setting up 2-wire and 3-wire control modes. These settings have been explained in depth in the explanation for parameter P5-15.
2	Reverse	
3	Three Wire	
4	Multiphase reference velocity 1 (S0)	16 levels of speed can be achieved using the multiphase reference velocity terminals.
5	Multiphase reference velocity 2 (S1)	
6	Multiphase reference velocity 3 (S2)	
7	Multiphase reference velocity 3 (S2)	
8	Forward Jog	Triggers forward jogging operation.
9	Reverse Jog	Triggers reverse jogging operation
10	Increase frequency	The input terminals are used to increase or decrease the set frequency value. The step size is decided by parameter P5-17. The frequency source (P0-01) has to be set to either 5 or 6.
11	Decrease frequency	
12	Acc - Dec time option 1 (A1)	The input terminals can be used to choose among 4 acceleration,deceleration time options as per the table below.
13	Acc - Dec time option 1 (A2)	

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0	0	0	0	Principal frequency	P0-03
0	0	0	1	Multiphase reference velocity 1	P8-01
0	0	1	0	Multiphase reference velocity 2	P8-02
0	0	1	1	Multiphase reference velocity 3	P8-03
0	1	0	0	Multiphase reference velocity 4	P8-04
0	1	0	1	Multiphase reference velocity 5	P8-05
0	1	1	0	Multiphase reference velocity 6	P8-06
0	1	1	1	Multiphase reference velocity 7	P8-07
1	0	0	0	Principal frequency	P8-08
1	0	0	1	Multiphase reference velocity 8	P8-09
1	0	1	0	Multiphase reference velocity 9	P8-10
1	0	1	1	Multiphase reference velocity 10	P8-11
1	1	0	0	Multiphase reference velocity 11	P8-12
1	1	0	1	Multiphase reference velocity 12	P8-13
1	1	1	0	Multiphase reference velocity 13	P8-14
1	1	1	1	Multiphase reference velocity 14	P8-15

$	$	$FF 'HF WLPH RSWLRQ VHOHFWHG	3DUDPHWHUV
0	0	Acc - Dec time 0	P0-04 and P0-05
0	1	Acc - Dec time 1	P12-00 and P12-01
1	0	Acc - Dec time 2	P12-02 and P12-03
1	1	Acc - Dec time 3	P12-04 and P12-05

6HWWLQJ9DOXH	)XQFWLRQ	'HVFULSWLRQ
12	Acc - Dec time option 1 (A1)	The input terminals can be used to choose among 4 acceleration,deceleration time options as per the table below.
13	Acc - Dec time option 1 (A2)	
14	Stop of Acc-Dec	The terminal can be used to hold the drive at its current speed.
15	External fault input	The terminal can be used to trigger an external fault condition.
16	Fault reset	The terminal can be used to reset a fault condition. The operation is similar to the RST key on the keypad.
17	Regular stopping	The input can be used to trigger a stopping action. The drive will follow the stop mode as set in parameter P2-05.
18	External count value input	The input can be used to increment the internal counter.
19	Count clear	The input can be used to reset the internal counter to 0.
20	Program run	The input can be used to start the running of the Simple PLC feature.
21	Pause of program run	The input can be used to pause the running of the Simple PLC feature.
22	DC Braking	The input can be used to trigger a stopping action. In this case, irrespective of the setting in P2-05, the drive will follow the DC brake assisted stopping routine.
23	E Stop	The input can be used to trigger emergency stop
24	Hand function	The input can be used to trigger Hand operation and switch the frequency source.

$	$	$FF 'HF WLPH RSWLRQ VHOHFWHG	3DUDPHWHUV
0	0	Acc - Dec time 0	P0-04 and P0-05
0	1	Acc - Dec time 1	P12-00 and P12-01
1	0	Acc - Dec time 2	P12-02 and P12-03
1	1	Acc - Dec time 3	P12-04 and P12-05

	X1 On delay	0.0 to 999.9s	0.0s
	X2 On delay	0.0 to 999.9s	0.0s
	X3 On delay	0.0 to 999.9s	0.0s
	X4 On delay	0.0 to 999.9s	0.0s
	X5 On delay	0.0 to 999.9s	0.0s
	X6 On delay	0.0 to 999.9s	0.0s
	X7 On delay	0.0 to 999.9s	0.0s
	X8 On delay	0.0 to 999.9s	0.0s

	X1 Off delay	0.0 to 999.9s	0.0s
	X2 Off delay	0.0 to 999.9s	0.0s
	X3 Off delay	0.0 to 999.9s	0.0s
	X4 Off delay	0.0 to 999.9s	0.0s
	X5 Off delay	0.0 to 999.9s	0.0s
	X6 Off delay	0.0 to 999.9s	0.0s
	X7 Off delay	0.0 to 999.9s	0.0s
	X8 Off delay	0.0 to 999.9s	0.0s

These parameters allow user to select the turn on and off delay for the multifunction input X1 to X5.

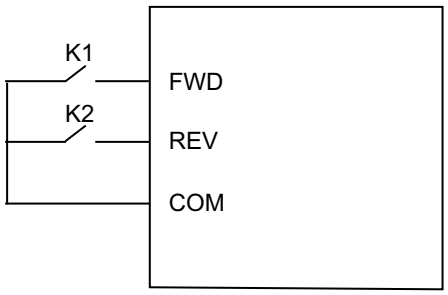
	Input off delay interruption	0 : Disable; 1 : Enable	1

This parameter allow user to interfere the input given to multifunction point when they are operating in off delay time. Enable option should be selected when the user wants to interrupt the operation after the command is given and delay off time is running. When selected disable, user will not be allowed to interrupt the delay off period.

	Terminal control mode	Stop at power on: 0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2 Auto - Run at power on: 4: Two-wire control mode 1 5: Two-wire control mode 2 6: Three-wire control mode 1 7: Three-wire control mode 2	0

This parameter decides the control technique that will be followed when the user selects P0-02 as 1 or 2. 0/4: Two-wire control mode 1

Two-wire control mode 1 is the most commonly used terminal control mode. One terminal acts to trigger FWD rotation while the other acts to trigger REV operation. The below diagram helps to illustrate this more easily

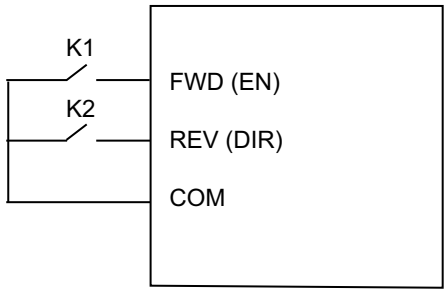


K1	K2	Command
0	0	Stop
0	1	Reverse Run
1	0	Forward Run
1	1	Stop

Fig.6.13 Two-wire control mode 1

1/5: Two-wire control mode 2

In Two-wire mode 2 one terminal acts as an enable pin while the second terminal controls the Direction. Refer to the illustration below to understand better

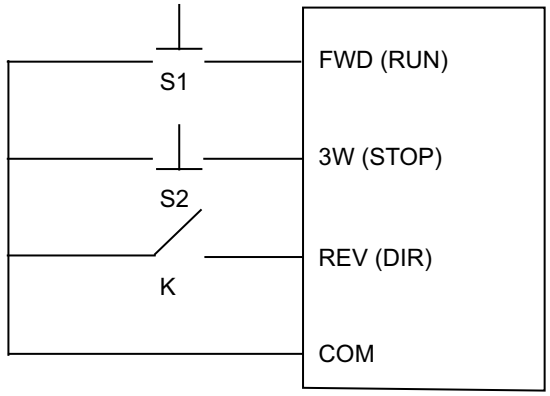


K1	K2	Command
0	0	Stop
0	1	Stop
1	0	Forward Run
1	1	Reverse Run

Fig.6.14 Two-wire control mode 2

2/6: Three-wire control mode 1

The Three-Wire Control Mode 1 combines a switch with 2 momentary push button. The switch is used for controlling the direction of rotation. of the 2 momentary buttons, 1 is NO and the other is NC. The NO switch is used for the RUN command while the NC switch is used for the STOP command. The illustration below explains this.

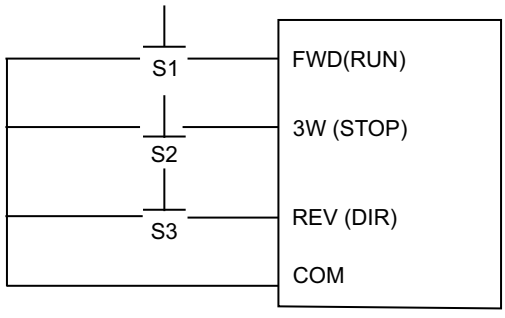


K	0	FWD
	1	REV
S1	Run	
S2	Stop	

Fig.6.15 Three-wire control mode 1

3/7: Three-Wire Control Mode 2

The Three Wire control mode 2 uses 3 momentary push button for its operation. Push button S3 is used to reverse the direction of motor. Momentary push button S1 (NO) is used for RUN command and S2 (NC) is used for the STOP command.



S1	Forward
S2	Stop
S3	Reverse

Fig.6.16 Three-wire control mode 2

0,1,2,3 belong to the 'Stop at Power On' group, meaning if any DI is executing its terminal control mode task when power is cut off, the DI operation will be ignored upon power restoration until toggled off and on again.

4,5,6,7 belong to the 'Auto-Run at Power On' group, meaning if any DI is executing its terminal control mode task when power is cut off, the DI operation will resume automatically upon power restoration.

	Terminal filtering time	2ms - 100ms	10ms

This parameter allows the user to customize the debounce time being used for the multifunction input terminals. An increase in the filter time can protect the terminal from false activation in noisy environments. However, that will also adversely affect the sensitivity of the terminals.

	Terminal frequency update step size	0.0- Upper Limit of Frequency (P0-09)	0.1 Hz

This parameter defines the step size that will be used in cases where the set frequency is being updated using the multifunction input terminals.

3 2XWSXW IXQFWLRQ WHUPLQDOV

	Y1 Output options	0: Disable 1: Running 2: Direction 3: Fault output 4: Pre-Alarm 5: Standby 6: Frequency arrived 7: Frequency detected 8: Upper limit frequency 9: Lower limit frequency 10: Setting count value received 11: Specified count value received 12: POT signal loss threshold reached 13: AI Signal loss threshold reached 14: Dormancy detection 15. Hand detection 16. Running status (DO will be high till output Freq. reaches zero)	1
	Y2 Output options		2
	Relay1 output options		3
	Relay2 output options		0

The parameters above define the function of the transistor and relay output terminals, and their status can be viewed on the Output Terminal Status page of the HMI. These functions are explained in the table below.

6HWWLQJ9DOXH	)XQFWLRQ	'HVFULSWLRQ
0	Disable	The output terminal is not used for any task
1	Running	The output terminal is used to denote that the drive is in Running condition
2	Direction	The output terminal is used to denote the direction that the drive is operating in. A HIGH signal would indicate REV operation and a LOW signal would indicate FWD operation
3	Fault output	The output terminal is used to denote the presence of a fault condition
4	Pre-Alarm	The output terminal is used to indicate the presence of a pre-alarm condition
5	Standby	The output terminal is used to denote that the drive is in standby mode
6	Frequency arrived	The output terminal is used to denote the FAR condition. Refer parameter P12-14
7	Frequency detected	The output terminal is used to denote the FDT condition. Refer parameters P12-12 and P12-13.
8	Upper limit frequency	The output terminal denotes that the drive has attained the upper limit of frequency (P0-09)

6HWDO9XH	)XQFWLRQ	'HVFULSWLRQ
9	Lower limit frequency	The output terminal denotes that the drive has attained the lower limit of frequency (P0-10)
10	Setting count value reached	The output terminal denotes that the internal counter has reached the setting count value (P12-15)
11	Specific count value reached	The output terminal denotes that the internal counter has reached the specific count value (P12-16)
12	POT signal loss threshold reached	Denotes that the input signal at POT has gone below the user defined threshold value set in parameter P5-05 or that POT is disconnected. Only works when drive is running
13	AI signal loss threshold reached	Denotes that the input signal at AI has below the user defined threshold value set in parameter P5-11 or that AI is disconnected. Only works when drive is running
14	Dormancy detection	The output terminal is used to denote dormancy detection condition
15	Hand detection	The output terminal is used to denote hand detection condition

[redacted]	AO options	0: Operating frequency 1: Output current 2: Bus voltage 3: Output voltage 4: AI retransmission	0

The setting in P6-02 specifies which parameter will be used to scale the analogue output signal. The corresponding range of the individual parameters is as follows

6HWDO9XH	)XQFWLRQ	'HVFULSWLRQ
0	Operating frequency	0 to Upper limit frequency (P0-09)
1	Output current	0 to Rated current (P3-02)
2	Bus voltage	260 to 400V (in case of 230V AC units) or 500-700V (in case of 415V AC units)
3	Output voltage	0 to Rated voltage (P3-01)
4	AI retransmission	The AI voltage or current signal is retransmitted through AO voltage or current, and selecting AI as the frequency source in P0-01 is not required for this to work.

[redacted]	AO Correction coefficient	0.0 to 250.0%	100.0%

This parameter can be used to adjust the gain of the analogue output for field calibration. The actual analogue output will be calculated as Analog Output = (Calculated analogue value x P6-03)/100

[redacted]	AO Current range selection	0: 0~20mA 1: 4~20mA	0

This parameter is used to change the range of the analog output-current

3 ± 3, &RQWURO 3DUDPHWHUV

3URFHGXUH WR VHW 3, YDOXHV DV SHU UHTXLUHPHQW

The default set values for PI gain is 1.0 and for integral time is 1.0s. The first step is to start the VFD and operate on RUN mode. Check wheather the set point values are achieved within correct time intervals. If set points are not achieved within required time period, then user can reset the values of PI controller. While keeping the drive on RUN mode, slightly increase the PI gain untill the drive reaches stable operation. Once the stability is achieved, reduce the PI gain to minimize the oscillations. By increasing the value of gain, user can achieve fast response from the drive but, along with that the overshoot and settling time will also be increased. Hence it all depends on user to achieve fast responce or to achieve fast settling. The relation between PI gain and time is given in following table.

5HVSRQVH	5LVH7LPH	2YHUVKRRW	6HWWOLQJ7LPH	6WHDG\6WDWH(U
Increase Gain	Decrease	Increase	No Effect	Decrease
Increase Time	No Effect	Decrease	Decrease	No Effect

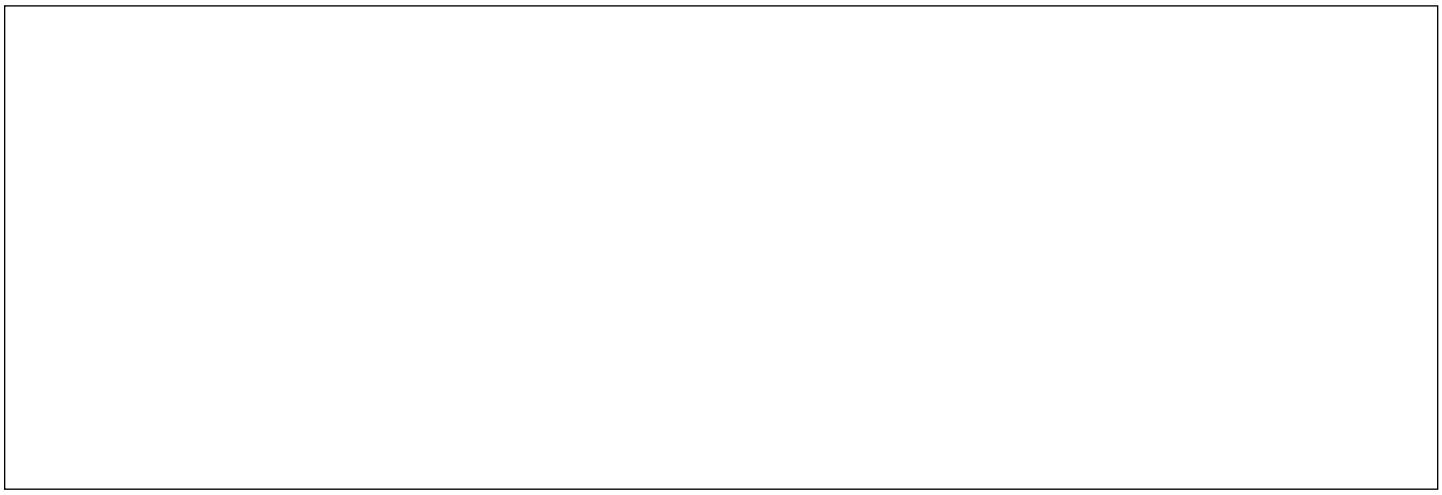


Fig.6.17 System response overtime

	PI reference source	0: Keyboard; 1: Panel encoder; 2: Analog channel POT	0

The PI Control parameters are used when PI control has been chosen as the frequency control source in P0-01.
Choose the source which will provide the reference value for the PI control loop displayed on the PI Index value page

	Display scaling high for PI values	P7-02 to 999.9	100.0

	Display scaling low for PI values	0.0 to P7-01	0.0

The DSH (Display Scaling High) and DSL (Display Scaling Low) parameters define the range of the PI Set Value. The DSH parameter sets the maximum value of this range, while the DSL parameter sets the minimum value. Together, they determine the span of data that will be displayed or measured.

For example, if you set DSH = 10.0 and DSL = 5.0, the system will interpret values within this range, such as 5.0 to 10.0. This could represent various units, like 5.0V to 10.0V or 5.0 bar to 10.0 bar, depending on the user's system context.

By adjusting the DSH and DSL values, the display range can be customized to suit the user's specific needs.

	PI set value	P7-02 - P7-01	0.0

Choose the set value for the PI control loop. This setting is used when the value in P7-00 is 0 or 1

	Feedback source	0:AI	0

Use this parameter to set the source of the feedback signal.

	PI output characteristics options	0: Positive 1: Negative	0

Positive PI output characteristics: output frequency must be lowered to make it balance when the value of feedback signal is greater than PI set value, for example, PI control on winding tension.
Negative PI output characteristics: output frequency must be increased to make it balance when the value of feedback signal is greater than PI set value, for example, PI control on unwinding tension.

	Proportional gain	0.0 to 10.0	1.0
	Integral time	0.0 to 100.0s	1.0s

3 U R S R U W L R Q G H W H U P L Q H V the intensity of adjustment of PI regulator; the larger P-value is, the higher the intensity of adjustment will be.

, Q W H J U D O W L P H determines the speed of integral regulation on the difference between PI feedback quantity and given quantity. The less integral time is, the higher the intensity of adjustment will be. PI is the most common control method for process control; the function of each part is different from the other. Please refer to the following brief introduction of operating principles and regulation methods:

3 U R S R U W L R Q D O G H W H U P L Q H V There will be a proportional adjustment between output and deviation if there is a difference between feedback value and set value; if the deviation is constant, regulating variable is also constant. Proportional control responses to the change of feedback quickly; however, error control can't be proceeded only by proportional control.
The greater the proportional gain is, the smaller the adjusting speed of the system will be. But the proportional gain is excessive, it may cause vibration. The adjustment method is to extend the integral time and make the system running only by proportional control; meanwhile, the set value should be changed to observe its stable deviation (static error) between the feedback signal and given quantity; if the static error is incompatible with the change of given quantity, proportional gain can be increased continuously, for example increasing given quantity, or feedback quantity is always less than given quantity after system is stable; otherwise, please reduce it. The instruction above should be implemented repeatedly until deviation is optimized/ minimized.

, Q W H J U D O W L P H when there is difference between feedback value and set value, regulating variable of output should be accumulated continuously; if the deviation can't be eliminated, the regulating variable should be increased continuously until there is no deviation. Deviation can be eliminated effectively by integral controller. However, overshoot may be caused repeatedly if the adjustment of integral controller is too much, which makes system unstable and even causes vibration. If vibration is caused by excessive integral action, following characteristics can be observed oscillation of feedback signal on given quantity, expanding amplitude of oscillation, even vibration. The parameter of integral time should be adjusted generally from maximum value to minimum value so that the integral time can be changed gradually. Observation should be made on the effect on the system. Adjustment can't be stopped until the sable speed of system meets the requirements

	Deviation limit	0.0 to 20.0	2.0

Deviation limit of PI control defines the comparison between PI system output and maximum deviation value which is limited by closed-loop set value. As is shown in the graph, PI regulator is shut down while it's within deviation limit. The precision and stability of PI system can be improved by setting this function code properly.

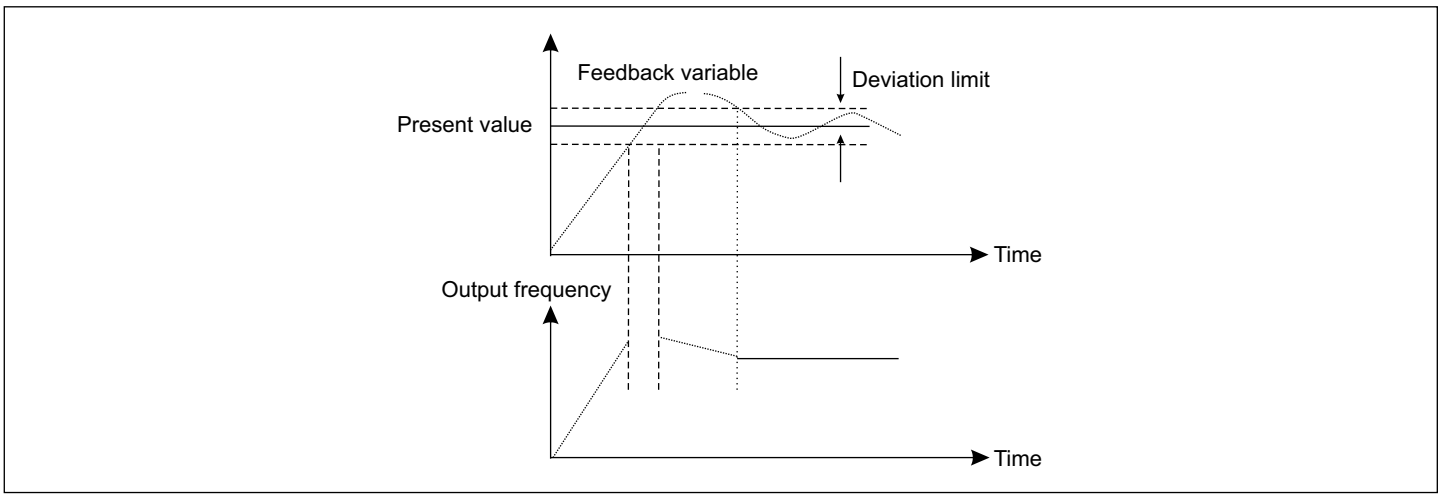


Fig.6.18 Deviation limit

	Sampling time	0.1 to 100.0s	0.2s

Sampling period (T) means sampling period of feedback quantity; operation is performed by regulator once every one sampling period. The longer sampling period is, the slower response will be.

	Feedback disconnection value	0.1% to 50.0%	0.1%
	Feedback disconnection detection time	0.1 to 100.0s	10.0s

The feedback variable of PI can be always detected by system; if feedback variable is less than the detected value of feedback disconnection, system will consider feedback signal to be disconnected by default; if feedback variable is still less than the detected value of feedback disconnection while actual time is more than the time for detecting feedback disconnection, PIE can be detected and sent out by the system.

	Dormancy value	P7-02 to P7-01	0

The VFD enters standby mode and stops running after the dormancy time when certain conditions are met, based on the AI feedback value and the PI output characteristic setting (P7-05). If the PI output characteristic is set to Positive, the VFD enters standby only when the AI feedback value exceeds the dormancy threshold. Conversely, if the characteristic is Negative, the VFD enters standby only when the AI feedback value falls below the dormancy threshold.

The analog feedback signal, whether 0 to 10V, 0 to 20mA, or 4 to 20mA is internally scaled to a 0-100% range, as displayed on the PI feedback value page. Both the dormancy and wakeup thresholds are defined in this scaled range to ensure accurate and consistent control.

For instance, with DSL = 10.0 bar, DSH = 20.0 bar, and a dormancy value of 14.0 bar (scaled to 40%), the VFD will enter standby when the AI feedback exceeds 14.0 bar (e.g., 15.0 bar = 50%) if the characteristic is Positive, or falls below 14.0 bar (e.g., 12.0 bar = 20%) if Negative.

	Dormancy time	0.0 s to 50.0s	0.0s

VFD remains on standby mode after dormancy time.

	Wake up value	P7-02 to P7-01	0.0

Once in standby, the VFD resumes PI regulation only after the AI feedback reaches the wakeup threshold and the wakeup time has elapsed. If the PI output characteristic is Positive, the VFD wakes up only when the AI feedback falls below the wakeup value. If the characteristic is Negative, the VFD wakes up only when the AI feedback rises above the wakeup value.

For example, consider above example and if the wakeup value is 11.0 bar (scaled to 10%), the VFD (with a Positive PI output characteristic) will resume regulation when the AI feedback drops below 11.0 bar. Conversely, if the wakeup value is 17.0 bar (scaled to 70%), the VFD (with a negative PI output characteristic), the VFD will wake up when the AI feedback rises above 17.0 bar.

Note: For Positive characteristics, dormancy is always set above the PI set value and wakeup below it, while for Negative, dormancy is below and wakeup above the PI set value.

	Wake up time	0.0s to 50.0s	0.0s

VFD starts PI regulation after wakeup time.

3 6LPSOH 3/& DQG 0XOWLVSHHG SDUDPHWHUV

	Program run mode	0: Disable 1: Program stops after running for one cycle 2: Program runs for one cycle and then continues at last operating frequency 3: Circulatory running of the program	0

This parameter selects how the Simple PLC program will run

0: Simple PLC operation is disabled.

1: The program runs once and then the operation stops.

2: The program runs once and then continues operating at the last frequency in the sequence.

3: The program runs in a cyclic sequence continuously till deliberately stopped.

Note : Simple PLC Programs execute when the Control mode for running (P0-02) is set to 1 or 2, meaning control is via terminals, and Program Run is triggered by a DI

	First phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	11.0 Hz
	Second phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	12.0 Hz
	Third phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	13.0 Hz
	Fourth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	14.0 Hz
	Fifth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	15.0 Hz
	Sixth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	16.0 Hz
	Seventh phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	17.0 Hz
	Eighth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	18.0 Hz
	Nineth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	19.0 Hz
	Tenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	20.0 Hz
	Eleventh phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	21.0 Hz
	Twelveth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	22.0 Hz
	Thirteenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	23.0 Hz
	Fourteenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	24.0 Hz
	Fifteenth phase speed	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	25.0 Hz

The parameters above determine the 15 phase speeds in the simple PLC program. The principal frequency is set in parameter P0-03 and can be assigned to any frequency source selected in the P0-01

	The runtime of principal frequency	0.0-6400.0	0.0
	First phase time	0.0-6400.0	0.0
	Second phase time	0.0-6400.0	0.0
	Third phase time	0.0-6400.0	0.0
	Fourth phase time	0.0-6400.0	0.0
	Fifth phase time	0.0-6400.0	0.0
	Sixth phase time	0.0-6400.0	0.0
	Seventh phase time	0.0-6400.0	0.0
	Eighth phase time	0.0-6400.0	0.0
	Nineth phase time	0.0-6400.0	0.0
	Tenth phase time	0.0-6400.0	0.0
	Eleventh phase time	0.0-6400.0	0.0
	Twelveth phase time	0.0-6400.0	0.0
	Thirteenth phase time	0.0-6400.0	0.0
	Fourteenth phase time	0.0-6400.0	0.0
	Fifteenth phase time	0.0-6400.0	0.0

These parameters determine the time for which the frequencies set in P0-03 and P8-01 to P8-07 will be running. The operation is as shown in the timing diagram below.

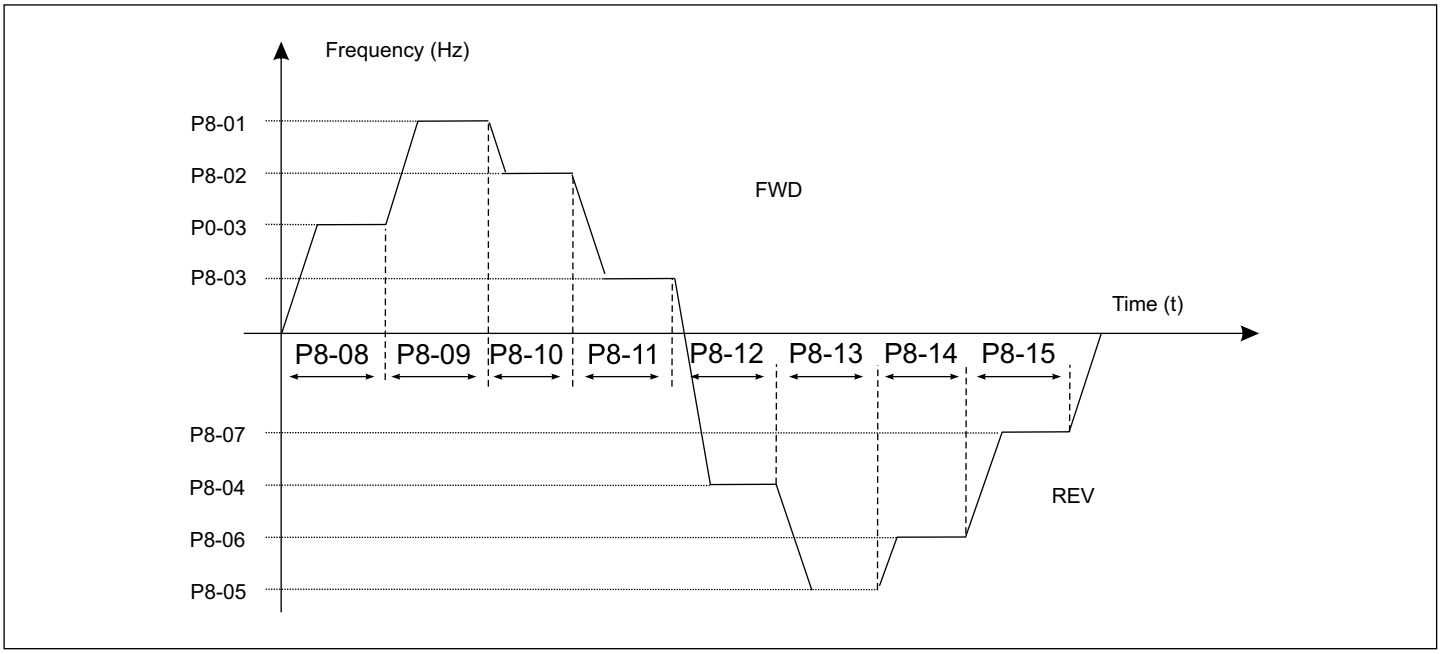


Fig.6.19 Multispeed operation

	Time unit of multi-velocity	0: Seconds 1: Minutes 2: Hours	0

The P8-16 parameter defines the time unit that will be used for the time settings in P8-08 to P8-15

	Running direction of programs	0-255 BIT0-7 indicates directions for 0-7 phase speeds (0:FWD 1:REV)	0

The P8-17 parameter determines the direction that will be followed for the individual phases in the simple PLC program.

: HLJKWHG YDOXH	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
'LUHFWLRQ H[DPSOH		1	0	1	0	0	1	0
%LW 1R	7	6	5	4	3	2	1	0
3KDVH 1R	7	6	5	4	3	2	1	0

Each bit in the byte corresponds to the corresponding phase in the simple PLC program as shown in the table above.
A value 0 in the bit corresponds to a FWD direction rotation while writing a value 1 to the bit will cause REV direction rotation.
In the above example, we have phases 0 (principal frequency), 2, 3, and 5 running in the forward direction while phases 1, 4, 6, and 7 will run in the reverse direction. The parameter value comes out to be $2^1+2^4+2^6+2^7$ i.e. 210.

	Acc-Dec Time1 for each phase	0-65535 BIT0-15 indicated acc/dec times for 0 - 7 phase speeds	0
	Acc-Dec Time2 for each phase	0-65535 BIT0-15 indicated acc/dec times for 8 - 15 phase speeds	0

: HLJKWHG YDOXH	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
7LPH VHOHFWLRQ H[DPSOH	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1
%LW 1R	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3KDVH 1R	7		6		5		4		3		2		1		0	

The P8-18 parameter determines the acceleration or deceleration times that will be followed for the individual phases in the simple PLC program. In the 16-bit word, every 2-bit data corresponds to the acc/dec time selection for the respective phase. The 2-bit data corresponds to 4 distinct Acc/Dec times as shown in the table below.

06%	/6%	$FF 'HF WLPH VHOHFWLRQ 3DUDPHWHU &RGH
0	0	0	P0-04 and P0-05
0	1	1	P12-00 and P12-01
1	0	2	P12-02 and P12-03
1	1	3	P12-04 and P12-05

In the example given above, phases 4 through 7 will follow acc/dec times 0;phases 0 and 1 will follow acc/dec times 1; phase 2 will follow time acc/dec times 2; phase 3 will follow acc/dec times 3. Converting the time selection word from binary to decimal, we get (0000000011100101)2 = (229)10, which is the value that needs to be stored in the parameter P8-18 and end the line with full stop

3 3URWHFWLRQ SDUDPHWHUV

	Overload protection enable	0: Disable 1: Enable	1
	Critical value of Overload protection	50-200%	150%
	Overload detection time	0.1 to 3600.0s	60.0s
	Overload pre-alarm enabled	0: Disable 1: Enable	0
	Overload pre-alarm detection level	50% to Critical value of overload protection (P9-01)	95%
	Overload pre-alarm detection time	0.1 to 3600.0s	60.0s

The Overload protection is used to provide a degree of thermal protection to the motor. The pre-alarm feature can be used to highlight that the system is approaching the critical trip state so that corrective actions can be taken accordingly. The percentage values specified in the parameters P9-01 and P9-04 correspond to the percentage of the rated power of the motor as specified in the parameter P3-03. The delay times act as ON-delay for the trip and prealarm conditions specifying that the drive will trigger the fault or pre-alarm actions after the time (P9-02 and P9-05 respectively) has elapsed.

	Overvoltage protection enable	0: Disable 1: Enable	1
	Critical value of OV protection	1Ø: 220-275V 3Ø: 415-560V	1Ø: 265V 3Ø: 520V
	Overvoltage trip time	0.1 to 3600.0s	3.0s
	Overvoltage prealarm enable	0: Disable 1: Enable	0
	Overvoltage prealarm detection level	1Ø: 220-(P9-07) 3Ø: 415-(P9-07)	1Ø: 245V 3Ø: 450V
	Overvoltage prealarm detection time	0.1 to 3600.0s	3.0s

The overvoltage protection feature protects the drive from operating in ranges beyond the safe operating limits. The pre-alarm feature provides an early warning to the user for taking corrective actions before the drive executes the tripping action.

	Undervoltage protection enable	0: Disable 1: Enable 2: Fault auto-reset	0
	Critical value of Under-voltage protection	1Ø: 180V-240V 3Ø: 315V-415V	1Ø: 195V 3Ø: 350V
	Undervoltage trip time	0.1 to 3600.0s	3.0s
	Undervoltage prealarm enable	0: Disable 1: Enable	0
	Undervoltage prealarm detection level	1Ø: (P9-13)-240V 3Ø: (P9-13)-415V	1Ø: 200V 3Ø: 380V
	Undervoltage prealarm detection time	0.1 to 3600.0s	3.0s

Undervoltage protection feature protects the drive from operating in ranges under the safe operating limits. The prealarm feature provides an early warning to the user for taking corrective actions before the drive executes the tripping action.

	Overcurrent protection enable	0: Disable 1: Enable	1
	Critical value of Overcurrent protection	50-200%	150%
	Overcurrent trip time	0.1 to 3600.0s	60.0s
	Overcurrent prealarm enable	0: Disable 1: Enable	0
	Overcurrent prealarm detection level	50% to (P9-19)	85%
	Overcurrent prealarm detection time	0.1 to 3600.0s	60.0s

The overcurrent protection feature works by allowing the user to set the maximum current that the drive will source to the motor. This protects the motor windings from damage due to excessive current flow. The timings and prealarm functions operate just like other protection parameters.

	Undercurrent protection enable	0: Disable 1: Enable	0
	Critical value of Undercurrent protection	20 to 90%	25%
	Undercurrent trip time	0.1 to 3600.0 s	5.0s
	Undercurrent prealarm enable	0: Disable 1: Enable	0
	Undercurrent prealarm detection level	(P9-25) to 90%	50%
	Undercurrent prealarm detection time	0.1 to 3600.0s	5.0s

Undercurrent protection is usually used to prevent motor damage when operating certain pumps and similar applications. Please note that this feature is disabled by default.

	Output single phasing protection	0: Disable; 1: Enable	0

This parameter allow user to enable or disable single phasing output protection.

	Low power actions	0: Coast; 1: Continue; 2: Recovery	1

The low power actions can be used to continue drive operation even in cases where the supply power has degraded. It protects the system from complete shutdown but only allows limited operating speeds.

	Automatic current limit	0: Disable 1: Enable	0
	Automatic current limit level	50-180%	150%

In cases where the motor acceleration has been set as too high, there is a possibility of the drive facing overcurrent faults. The automatic current limit feature helps mitigate those conditions by holding the speed of the motor till the current value becomes lesser than the threshold value. This feature is usually useful in cases where the starting load may not be constant and the user wants to extract the fastest acceleration.

3) D X O W K L V W R U \

The fault history section helps in analysing the faults faced by the drive.

	Previous fault code	0-20	0
	2nd to previous fault code	0-20	0
	3rd to previous fault code	0-20	0

These parameters store the last three fault codes

	Previous fault operating frequency		
	Previous fault current		
	Previous fault bus voltage		

These parameters store the operating frequency, current and bus voltage values for the previous fault.

	Previous fault input state		
	Previous fault output state		

These parameters store the status of the input and output terminals at the time of fault generation.

3 & R P P X Q L F D W L R Q S D U D P H W H U V

	G H ' H V F U L S W L R Q	6 H W W L Q J V D Q G 5 D Q J H	' H I D X O W V H
	Slave address	1-127	1
	Communication baud rate	0: 1200; 1: 2400; 2: 4800; 3: 9600; 4: 19200; 5: 38400; 6: 57600; 7: 115200	3
	Modbus data format	0: 8-N-1; 1: 8-N-2; 2: 8-E-1 3: 8-E-2; 4: 8-O-1; 5: 8-O-2	0
	Response delay	0-200ms	20ms
	Serial timeout	0: Disable; 1: Time setting	0
	Serial timeout time setting	0.1-60.0s	5.0s
	Abnormal action selection	0: Warn & Continue operation 1: Continue operation without warning 2: Alarm shutdown (coast to stop) 3: Alarm shutdown (ramp to stop)	0

The above parameters deal with the external communication feature of the drive. The parameter P11-00 defines the slave ID that will be assigned to the VFD. Note that the drive always acts as a slave in the communication system. The parameter P11-01 defines the baud rate at which the communication system will operate. P11-02 defines the MODBUS data format that will be used. Note that these parameters need to be the same across all members of the communication system. The parameters P11-04, P11-05, and P11-06 deal with customizable timeout settings for the user. In systems where input is expected from the master device in every set period, this feature can be used to generate a time-out action wherein one of the options from P11-06 will be performed. This action will be triggered if no data is received from the master device in the time specified in P11-05. This feature should be used only in cases where there is a continuous stream of data being transferred between the drive and the master device. Otherwise, it could trigger an unnecessary fault.

3 ± (QKDQFHG SDUDPHWHUV

	Acc. time 1	0.1-3600.0s	20.0s
	Dec. time 1	0.1-3600.0s	20.0s
	Acc. time 2	0.1-3600.0s	20.0s
	Dec. time 2	0.1-3600.0s	20.0s
	Acc. time 3	0.1-3600.0s	20.0s
	Dec. time 3	0.1-3600.0s	20.0s

The acceleration deceleration times 1 through 3 are defined similarly as Acceleration - Deceleration time 0 as defined in the P0 parameter family

	Jog Acc. time	0.1-3600.0s	5.0s
	Jog Dec. time	0.1-3600.0s	5.0s

These 2 parameters define the acc/dec times for the jogging operation. Note that these times are also defined as the transition time between the Max Frequency as defined in (P0-08) to 0Hz.

	Hopping frequency 1 lower limit	Lower limit frequency (P0-10) to Hopping frequency 1 upper limit (P12-09)	0.0 Hz
	Hopping frequency 1 upper limit	Hopping frequency 1 lower limit (P12-08) to Upper limit frequency (P0-09)	0.0 Hz
	Hopping frequency 2 lower limit	Lower limit frequency (P0-10) to Hopping frequency 2 upper limit (P12-11)	0.0 Hz
	Hopping frequency 2 upper limit	Hopping frequency 2 lower limit (P12-10) to Upper limit frequency (P0-09)	0.0 Hz

Hopping action is required in cases where the VFD could drive the motor through a frequency that matches the resonant frequency of the system that is being controlled. This matching could cause the entire system to vibrate which could prove to be harmful in the long run. The hopping feature allows the user to skip through such resonant frequency values. The below diagram will make this operation clearer. Note that in case of an overlap between the 2 hopping frequency ranges, band 1 will get a higher priority.

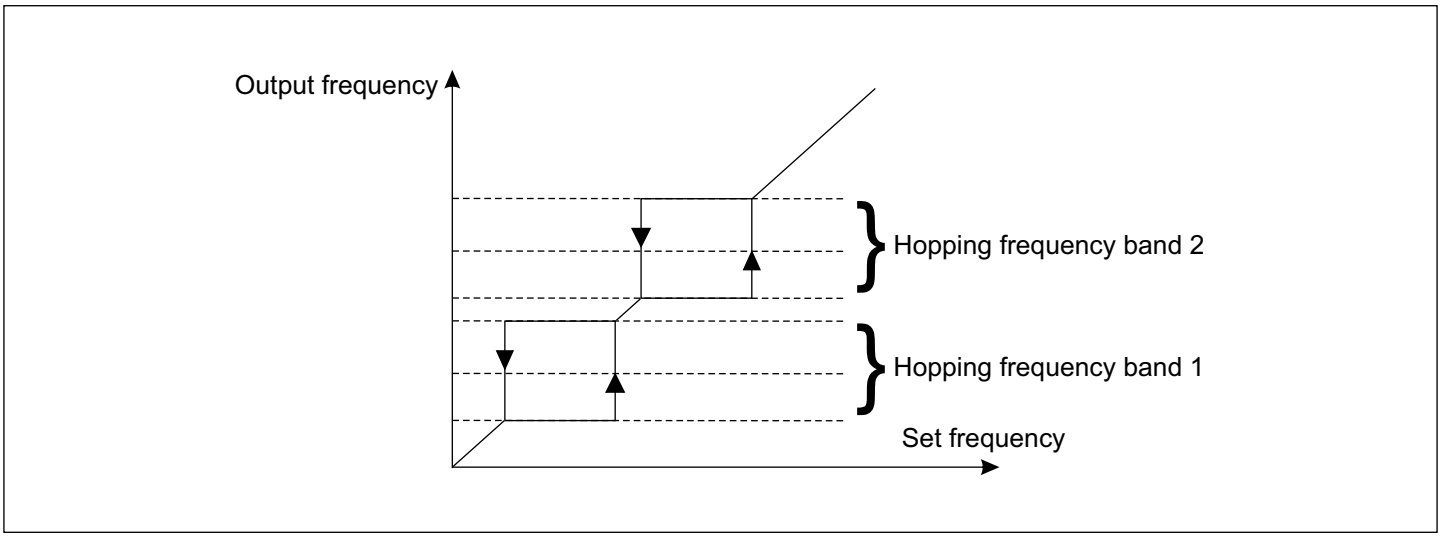


Fig.6.20 Frequency hopping

	FDT level detection value	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.0 Hz
	FDT level lagged value	Lower limiting frequency (P0-10) - FDT level detection value (P12-12)	0.0 Hz

These 2 parameters indicate that a particular frequency has been achieved. The operation is explained in the diagram below.

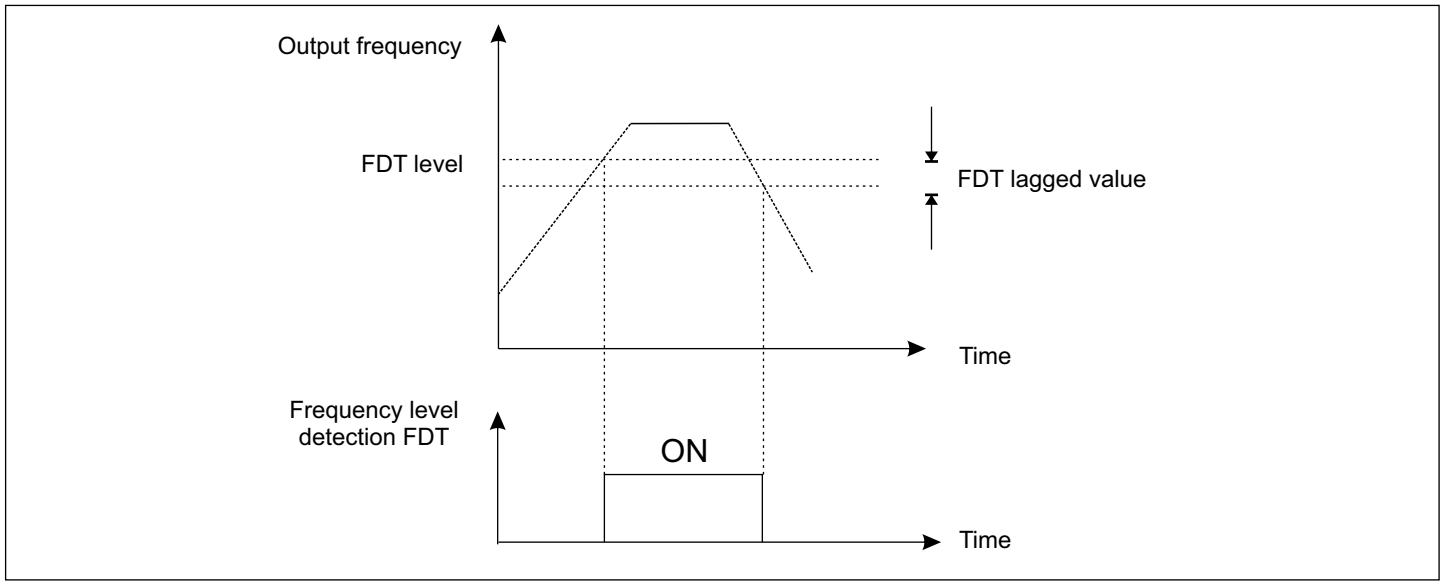


Fig.6.21 Frequency detection level

	Amplitude of frequency arrival	Lower limiting frequency (P0-10) - Upper limiting frequency (P0-09)	0.0 Hz

This parameter indicates that the drive is approaching the set frequency value

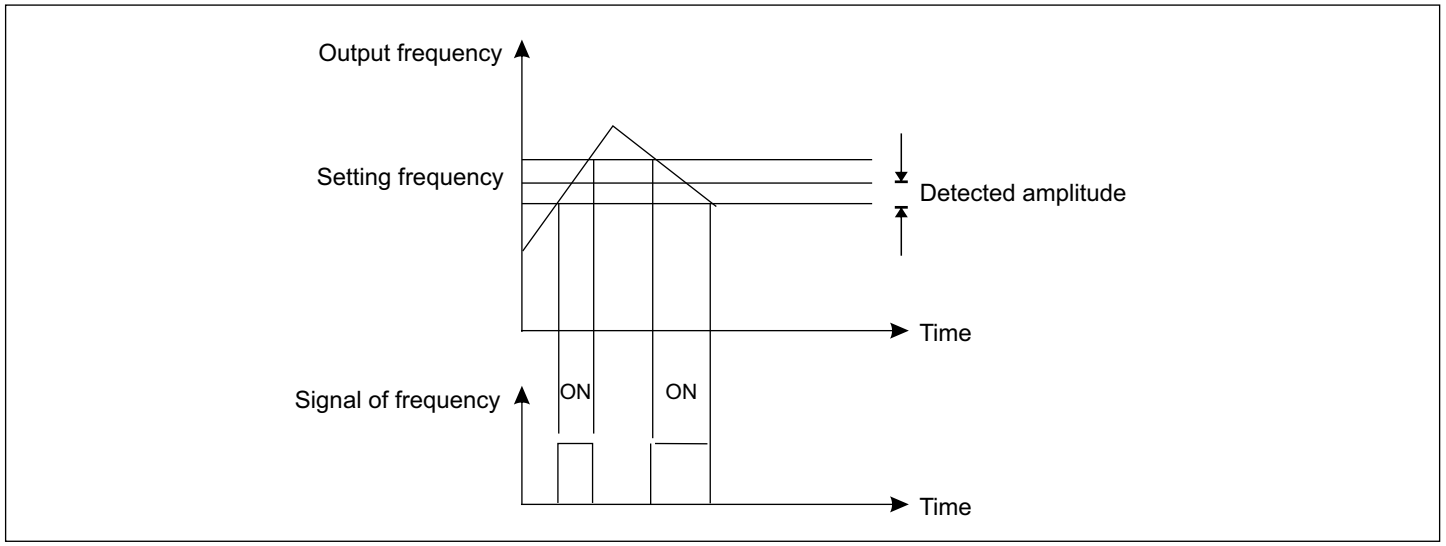


Fig.6.22 Amplitude of frequency arrival

	Setting count	1-65535	10
	Specific count	1-Setting count (P12-15)	10

Counts of pulse or switching signal can be input by the counter through one of its multi-function DI terminals. When the count value reaches up to the setting count value, the drive will signal this using one of the DO terminals or output relays. When the count value reaches up to the specified count value, the drive will give a similar signal using one of its DO or RO terminals. The counter will not stop until it reaches up to the setting count value. Once reached though, the counter will stay there till reset.

	Fan control	0: Always on 1: VFD run dependent 2: Temperature dependent	**1**

It is used to select the action mode of the cooling fan
0: The fan runs continuously after power-on
1: The fan runs when the AC drive is in run state
2: The fan runs depending upon the temperature of the AC drive

	DSP code version	-	-
	IO code version	-	-
	HMI code version	-	-
	HMI bootloader version	-	-
	Manufacturing code (YY / MM)	-	-

$8/7 +$1'/,1$1' 7528%/(6+227,1*
0DOIXQFWLRQ DQG 6ROXWLRQV

)DXOW &RGH	)DXOW ,QGLFDWLRQ	)DXOW 'HVFULSWLRQ	3RVVLEOH FDXVHV	3RVVLEOH VROXWLRQV
1	OU.t	Overvoltage fault	1. Input voltage 2. Rapid deceleration 3. Load with heavy inertia	1. Check input voltage is in permissible range 2. Increase deceleration time 3. Use dynamic braking resistor 4. Adjust the settings in protection parameters (P9)
2	UU.t	Under-voltage fault	1. Input Voltage	1. Check input voltage is in permissible range 2. Adjust the settings in protection parameters (P9)
3	OC.1	Over-current fault 1	1. Mismatch of capacity 2. Low supply voltage 3. Rapid acceleration/deceleration 4. Heavy load fluctuations	1. Select appropriately sized VFD 2. Check input voltage & wirings 3. Increase acceleration/deceleration times 4. Detect and reduce 5. Adjust the settings in protection parameters (P9)
4	UC.t	Under-current fault	Pump operating in dry run mode	Check system operation
5	OL.t	Overload fault	1. Similar to OC fault causes 2. Incorrect V/f settings 3. Excessive load on motor	1. Refer to above solutions 2. Recheck and select appropriate settings for V/f control 3. Reduce load on motor 4. Adjust the settings in protection parameters (P9)
6	Ot	Overheat fault	1. High ambient temperature 2. Obstruction to ventilation, fan malfunction, unclean heatsink 3. Excessive load on motor	1. Lower ambient temperature 2. Check that the ventilation ducts are not blocked and the placement of the drive is as per instructions. Check that the fan is working. If not, contact for replacement. Check for dust/debris on heat sink and clean if dirty 3. Reduce load on motor. Alternatively, reduce carrier frequency
7	OC.2	Over-current fault 2	1. Refer to the cases of OC fault. 2. Short circuit of output power terminals	1. Refer to above solutions for OC fault 2. Check condition of wires coming to the power terminals 3. Seek technical support
8	nF	External fault	1. External fault signal received from input terminals	1. Check input terminal setting to eliminate false alarms. In case a terminal has been set to trigger EF, check its status

9	COn	External communication failure	1. Erronous communication settings 2. Damaged	1. Crosscheck the communication settings across all devices communication wires connected to the network. 2. Check the status of the wires/cable used for communications
10	SYS	System failure	1. Critical damage to the system which could cause incorrect operation of the drive	1. Ensure HMI is connected to the main drive correctly. 2. Contact technical support
11	PIE	PI fault	No detection of PI feedback signal for a certain time	Check on PI feedback signal and connection
12	OPF	Output phase fault	The output phase connections to the motor have failed	1. Check the wires connected to output terminals. 2. Check the motor for internal shorting or terminals.
13	IOCOn	Internal communication error	Contact technical support	Contact technical support

& R P P R)Q D X CDWQVG U R F H VWFLQHJ P H V

1 R, Q I R U P DGWLVFSQDWSHUZ HRQ

Please ensure that the input power supply is as per the standard rated supply required to the converter. Ensure that the three phase recitifier is in working condition. If the recitfier is damaged please seek for the technical support. Please check that the power indicator is on. If it is not, then this malfunction is caused due to abnormal rectifier and charging resisitor. If it is on but still no information is being displayed, then the fault is mainly causing by switching power supply. If the application's demand is to use the HMI externally, make sure the connectors used are properly fitted on bergs. Any loose connection between the HMI display and bergs can cause flickering or complete turn off.

0 & % 6 Z L WFKLQJ R Z HUX S SOUZ SKVQR Z HLW X UQHQG

Please make sure that the power supply is properly grounded or short circuited. Also make sure that the switch or MCB is in properly working condition. Solve it accordingly, if any issues persists, contact technical support

0 R WRUH VVQWUDX QQDQWHKHR Q Y HUWHDU W H G

Please ensure that the three phase output supply of terminals U, V and W is symmetrical and proper. If the output supply is asymmetrical then the driver board or output model of the converter is damaged, in this case please contact the technical support team. If the output is proper and symmetrical and even afterwards if the problem is appearing, then there are higher chances that the motor is damaged itself or some part or circuit of the motor is damaged, or other mechanical problems are causing the stalling of the motor. In this case please ispect the motor carefully and solve accordingly.

0 & % 6 Z L WFKLQJ R Z HUX S SOUZ SKVLQ QLQJ

Please check for any shorting between the two phases in the power module. If it is short circuited, please contact to the technical support. Another reason of occurance of this fault is due to short circuiting between motor lines or lines being grounded. If this condition is there, solve accordingly. Always connect the motor to the drive via lugs, for the ideal lugs sizes refer to the appendix.

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Only the qualified engineer is allowed to conduct maintenance for converter; please pay attention to the following precautions:

- Maintenance must be conducted only by qualified engineers in specified way
- Wait for adequate time for the capacitors to discharge completely before taking on any kind of maintenance work. It is recommended that a time of at least 3 minutes (or as specified on the drive cover, whichever is higher) is given for the discharge operation.
- Do not touch the components on the PCB directly; otherwise, components can be damaged by static
- Make sure that all the screws are fastened after the maintenance.

* H Q H UDO Q W H QDQGS N H H S

Affected by environmental conditions (e.g. temperature, humidity or smog) and aging of internal components, the drive may malfunction. Therefore, routine inspection and maintenance on converter. For the detailed information of daily inspection and maintenance, please refer to the following table:

,WHPV	([DPLQDWLRQ 3HULRG		&KHFN 3RLQWV	&ULWHULD DQG PDLQWHQDQ
	1RQ SHULRGLF	3HULRGLF		
Environmental	✔		1. Temperature & Humidity 2. Dust, abnormal gases	1. Temperature in allowable range 2. Dust free environment. No flammable / explosive gases in vicinity
Cooling System		✔	1. Installation environment 2. Cooling fan 3. Heatsink	1. Good ventilation. No obstruction to air flow from the cooling fan. 2. Normal operation. No abnormal noise 3. No dust accumulation on the heatsink
Drive	✔		1. Vibrations, temperature 2. Noise 3. Leads and terminals	1. Unit stable during operation temperature rise within control 2. No abnormal noise from unit 3. All terminals fastened correctly. No stray wires.
Motor	✔		1. Vibrations, temperature rise 2. Noise	1. Stable operation and temperatures 2. No abnormal noise from the motor during operation

,QVSHFDWLRQ DQG PDLQWHQDQ

As for some of internal components, abrasion or performance degradation may be caused during use. To ensure stable and reliable operation, preventive maintenance on converter must be conducted. If necessary, please replace them:

The fan must be replaced after more than 20,000 hours of running.

The electrolytic capacitors must be replaced after approx 15,000 hours of running.

6WRUDJH

This product can't be taken out from box until it's about to be installed. To ensure that it's still valid for warranty and available for maintenance in the future during the period of storage, please pay attention to the following points:

- Relative humidity must be within the range between 0 % and 95 %; no condensation is permitted
- Ambient temperature must be within the range between -20 °C and +60 °C
- Converter must be stored in a dry place where there is no dust
- It must be protected from caustic fluids
- It must be packed properly and put on the shelf or desk.

3URGXFW DFUDQW\

- Unless specified, the warranty period for this product is 18 months but only 12 months for final buyer. During the period, any damage or fault without any wrong operation will be our responsibility to fix
- Maintenance fee will be charged accordingly if warranty expires
- Regarding the faults caused by the following points, extra fee will need to be charged as service fee:

1. Fault caused by faulty operation which is not in conformity with manual or specification
2. Fault caused by unauthorized maintenance modification
3. Damage caused during the transportation or improper safekeeping
4. Fault caused by misuse

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The drive features external communication on the form of MODBUS RTU over RS485 interface, which is compliant with International Communication Standards. Centralized control can be implemented by PC/PLC as well as superior controller to adapt specific requirements for applications, including setting of control command, operating frequency, modification of parameters for relevant function code, monitoring of operating status or malfunction.

3URWRFRO &RQWHQW

Modbus, also known as serial communication protocol, has defined its frames and format during the asynchronous transmission, including the format of polling to the host, broadcast frames and response fames to slave controller. The frames generated by the host included slave address/broadcast address, executive command, data & error correction; and the response of the slave controller has the similar frames as the host, including confirmation of instructions, data feedback and error correction. If any error happens when the slave controller receives the frames, or any instruction requested by the host can't be done, it will generate a malfunction frame and send feedback to the host.

$SSOLFDWLRQ PRGH

The drive is compatible with control network equipped with RS485 bus which has single host & multiple slave controllers.

%XV 6WUXFWXUH

1. Hardware Interface RS485 hardware interface
2. Transmission mode Serial, asynchronous, half-duplex communication
3. System with single host and multiple slave controllers the range of slave address should be 1~127; the number 0 stands for broadcast communication address. Every single slave address on the network is unique, which is the foundation of Modbus serial communication.

3URWRFRO ,QVWUXFWLRQV

The protocol of VFD-S Series Converter is a kind of serial & asynchronous communication protocol with principal and subordinate Modbus there is only one device (host) could set up protocol (named "query /command"), and the other devices (slave) can only response to the host's "query /command" by sending data, or issue commands/instructions according to the "query /command" from the host. The host herein mainly refers to personal computer, industrial control facility or Programmable Logic Controller (PLC); and the slave herein mainly refers to the drive or the other control facilities with similar/same communication protocol. The host can not only communicate with a certain slave controller independently but also send broadcast message to all the slave controllers. As to any independent access to the host's "query /command", message (called response) must be sent out from the slave controller; however, regarding the broadcast message issued by the host, it's not necessary for the slave controller to send feedback to the host.

)UDPH 6WUXFWXUH

In the RTU mode, the format of each byte is as follow: encoding system -8-bit binary system, there are two hexadecimal characters included in every 8-bit frame (hexadecimal characters include 0~9 & A-F). The transmissionof new frame will always be restarted with a interval of 3.5 bytes transmission time. When it's connected with the Internet of which transmission rate is calculated by Baud rate, 3.5-byte transmission time is easy to be controlled. The data fields of transmission will be sent in sequence as below: slave address - operating command code - data & CRC check word; and transmission byte of each field are hexadecimal (0~9, A~F). The networking devices will always monitor the operation of communication bus; when the first domain (address information) is received, it will be confirmed again by each networking device; when the transmission of last byte is done, there will be a interval of 3.5 bytes transmission time to identify the end of this frame. After that, transmission of new frame will be started again.

Frame format of RTU data					
MODBUDS Message					
Initiate; an interval of at least 3.5 bytes	Slave address	Function Code	Data	Verification	Terminate; an interval of at least 3.5 bytes

A frame message must be transmitted in a consecutive data stream; if the interval is more than 1.5-byte transmission time before transmission of the whole frame is finished, those incomplete messages will be cleared by the receiver which will take the next byte as part of address field of new frame by mistake; likewise, if the interval is less than 3.5- byte transmission time, the receiver will identify it as the extension of last frame. Because of disorder of frames, CRC value will be incorrect, which may result in malfunction.

6WDQGDUG VWUXFWXUH RI 578 IUDPH

Frame header	T1-T2-T3-T4 (3.5-byte transmission time)
Slave address	Communication address: 0~127(decimal system) / (Zero stands for broadcast communication address)
Function domain	0x03: reading parameters of slave controller 0x06: programming parameters of slave controller
Data field	2*N-byte data is not only the main content of communication but also the core of data exchange during the communication.
Checksum	Estimated value: CRC value (16BIT)
Frame termination	T1-T2-T3-T4 (3.5-byte transmission time)

&RPPDQG FRGH DQG GDWD GHVFULSWLRQ H[DPSOHV

)RUPDW RI 1R DGGUHVV IRU 6HWWLQJ DV IROORZV VHWWLQJ IUHTXH

+RVW FRPPDQG

Frame header	3.5 byte interval
Slave address	0x01
Function code	0x06
Register address	0x0003
Register information	0x01F4
Checksum	0x79DD
Frame termination	3.5 byte interval

6ODYH UHVSRQVH

Frame header	3.5 byte interval
Slave address	0x01
Function code	0x06
Register address	0x0003
Register information	0x01F4
Checksum	0x79DD
Frame termination	3.5 byte interval

)RUPDW RI 1R DGGUHVV IRU UHDGLQJ DV IROORZV VHWWLQJ IUHTXH

Note: register number must be one only when reading

+RVW FRPPDQG

Frame header	3.5 byte interval
Slave address	0x01
Function code	0x03
Register address	0x0003
Register information	0x0001
Checksum	0x740A
Frame termination	3.5 byte interval

6ODYH 5HVSRQVH

Frame header	3.5 byte interval
Slave address	0x01
Function code	0x03
Register address	0x0002
Register information	0x01F4
Checksum	0xB853
Frame termination	3.5 byte interval

)UDPH IRUPDW RI UHVSRQVH HUURU DV IROORZV VHWWLQJ IUHTXHQF\ +] 3

Type of error:
01H - Data address overrun
02H - Number of data overrun & read-in data content exceeding bounds (ceiling & floor)
03H - Operating, no read-in data are permitted

+RVW FRPPDQG

Frame header	3.5 byte interval
Slave address	0x01
Function code	0x06
Register address	0x0003
Register information	0x0258
Checksum	0x7950
Frame termination	3.5 byte interval

6ODYH UHVSRQVH

Frame header	3.5 byte interval
Slave address	0x01
Function code	0x86
Error code	0x0002
Checksum	0xC3A1
Frame termination	3.5 byte interval

&5& 0RGH

RTU frame format is mainly applied to CRC (Cyclical Redundancy Check), error detecting field based on CRC is included in the message. CRC domain can detect all the information of message, which is two bytes with 16-bit binary value included. It will be added into the message after the calculation of transmission devices. The receiver will recalculate the CRC receiving the message, and compare it with the values in the CRC domain received by devices; if the CRC value is not equivalent to another one, it proves that there is error in the transmission

CRC will write 0xFFFF in superior host, and call a program to process the consecutive 8 bytes in the message as well as the values in the register. Only 8-bit data of each character is valid to CRC, the others are all invalid, including start bit, stop bit and parity check bit.

During the operation of CRC, each of 8-bit character is exclusive (XOR) with register content separately; result will be inclined to the least significant bit(LSB) while the most significant bit will be filled with Zero. LSB will be extracted from the data for checking; if LSB is one, register will be exclusive(XOR) with preset value separately; if LSB is zero,
calculation will not be conducted. This instruction of process will repeat for 8 times; when it comes to the last bit (8th bit), the next 8-bit bytes will be exclusive(XOR) with register value again. The final value in the register is the CRC value after the calculations of all the bytes in the message.

When CRC is added into the message, lower byte will be added first, then the high byte. The simple function of CRC is as follows:

```
unsigned int crc_chk_value（unsigned char *data_value,unsigned char length）
{
        unsigned int crc_value=0xFFFF;
        int I;
        while（length--）
        {
                crc_value ^= *data_value++;
                for（i=0;i<8;i++）
                {
                        if（crc_value&0x0001）
                        {
                                crc_value=（crc_value>>1)^0xa001;
                        }
                        else
                        {
                                crc_value =（crc_value>>1);
                        }
                }
        }
        return（crc_value）;
}
```

5HDG ZULWH UXOHV RI SDUDPHWHU DGGUHVV IRU IXQFWLRQ FRGH

0RQLWRULQJ SDUDPHWHUV

$GGUHVV	3DUDPHWHU
30000	Set frequency
30001	Output frequency
30002	Carrier frequency
30003	Output current
30004	Output voltage
30005	Bus voltage
30006	Motor's RPM
30007	%Full load current
30008	IGBT temperature
30009	%Output power
30010	Count value
30013	Digital input status
30014	Digital output status
30017	Fault code
30018	DC current reading
30023	POT ADC values
30024	AI voltage ADC value
30025	AI current ADC value

&RPPDQGLQJ WKH GULYH RYHU FRPPXQLFDWLRQ

The control register address is 42000. The register values and actions are mentioned in the table below. Kindly note that the control mode for running (P0-02) should be set to “3: Control over Communication” for these settings to work.

9DOXH	6WRUHG DFWLRQ
1	FWD Run
2	REV Run
5	FWD Jog
6	REV Jog

9DOXH	6WRUHG DFWLRQ
8	Coast to stop
9	Normal stop
10	E-Stop
15	Fault reset

'ULYH VWDWXV

The address 30016 stores the current status of the drive.

9DOXH	6WRUHG DFWLRQ
1	FWD Run
2	REV Run
3	Standby
4	Fault Condition

$ 3 3 (1 ' , ;

% U D N L Q J U H V L V W R U F R Q V L G H U D W L R Q V

If the controlled motor decelerates too fast, or load jittering of the motor is too fast while the converter is running, its electromotive force will charge the internal capacitors of the converter through the converter's reverse function, which will raise the voltage of the power module and damage converter. However, this will be restrained by the converter's internal control according to the condition of loading an additional braking resistor needs to be installed externally to release the power in a time when braking performance doesn't meet Customer requirements. External braking resistor works by consuming energy which will be consumed completely by power braking resistor therefore, power and resistance of braking resistor must be applicable and effective. According to the application at hand, an appropriately sized resistor can be used to aid the dissipation of energy from the DC bus. Due to the energy consumption of the braking resistor, a mass of heat may be generated if the braking is performed frequently. Adequate measures must be taken to ensure safety. Our recommended values are as under –

3 5 2 ' 8 & 7 & 2 ' (	5 (& 2 0 0 (1 ' (' 9$ / 8 (	% U D N L Q J 8 Q L W
VFD-SH-3-050-B-415V	350W 150 Ω	Built In
VFD-SN-3-075-B-415V	500W 90 Ω	Built In
VFD-SH-3-075-B-415V	500W 90 Ω	Built In
VFD-SN-3-100-B-415V	800W 60 Ω	Built In
VFD-SH-3-100-B-415V	800W 60 Ω	Built In
VFD-SH-3-150-B-415V	1000W 47 Ω	Built In
VFD-SN-3-200-B-415V	1500W 36Ω	Built In
VFD-SH-3-200-B-415V	1500W 36Ω	Built In

7 H F K Q L F D O V S H F L I L F D W L R Q V

3 R Z H U V X S S O	Rated input voltage / frequency	Single phase 230V 50/60 Hz Three phase 415V 50/60 Hz
	Permissible voltage fluctuation	230V ±20 % for single phase 415V ±20% for three phase
	Permissible frequency fluctuation	±5%
& R Q W U R O & K D U D F W H U L V W L F	Control mode	Space vector PWM based scalar control
	Frequency control range	0.1~400.0 Hz
	Frequency accuracy	Digital setting 0.01%, Analog instruction 0.1% (Max frequency)
	Frequency resolution	Digital instruction 0.1 Hz, Analog instruction 0.1 Hz
	Acceleration / Deceleration time	0.1~3600.0s Four acceleration / deceleration time settings available
	Multi speed running	Built-in program using simple PLC feature
	Built-in PI	Easy to set up a simple automatic control system
	Built-in counter	Automatically controlled production line can be achieved

&RQWURO FKDUDFWHULVWLF	Overload capacity	150 % for 1 min, 180 % for 10 s, 200 % for 1 s
	V/F mode	4 pre-set V/f mode and 1 User Defined V/f program
	Energy efficient running	Changes the V/f curve according to the load to reduce energy consumption
	Automatic current limit	Handles behaviour of drive during accelerating heavy inertia loads which in other cases would cause an overcurrent condition
	Reduce power mode	Continues operation even when the grid is below ideal voltage levels.
	Automatic voltage regulation	Regulates the voltage automatically whenever there is a change in grid voltage
2SHUDWLRQ IXQFWLRQ	Operation commands	Keypad, External terminals, External communication using MODBUS
	Frequency setting	Keypad Up/Down keys, Keypad encoder, External potentiometer, Analog inputs (0-20 mA / 4-20 mA / 0-10 V), MODBUS communication
	Input signal	5 User Selectable (PNP/NPN) Multifunction Inputs, 2 Analog Input
	Output signal	1 User Selectable Multifunction Relay Output (250 V / 5 A Contact), 1 User Selectable Multifunction Open Collector Output, 1 Analog Output
3URWHFWLRQ IXQFWLRQV		Over Current, Over Voltage, Under Voltage, Over -Temperature, Overload, Under Current, PI Error & Output Phase Loss
'LVSOD\	Display parameters	Parameters setting, Running status and Fault display
	Display type	Removable HMI with 8 keys, 1 switch enabled encoder, 5x 7segment LED display & 7 status LEDs
([WHUQDO FRPP	Protocol	MODBUS RTU over RS485 with a maximum baud rate of 115200
2SHUDWLQJ FRQGLWLRQV	Operating environment	Temperature: -10 °C ~ +60 °C, Humidity: <90%, No condensation, IP20
	Operating area	Indoor, <1000 m altitude above sea level
	Storage temperature	-20 °C ~ +65 °C
	Vibration	<5.9 m/s^2 (0.6 g)

.H\SDG 'LPHQVLRQ

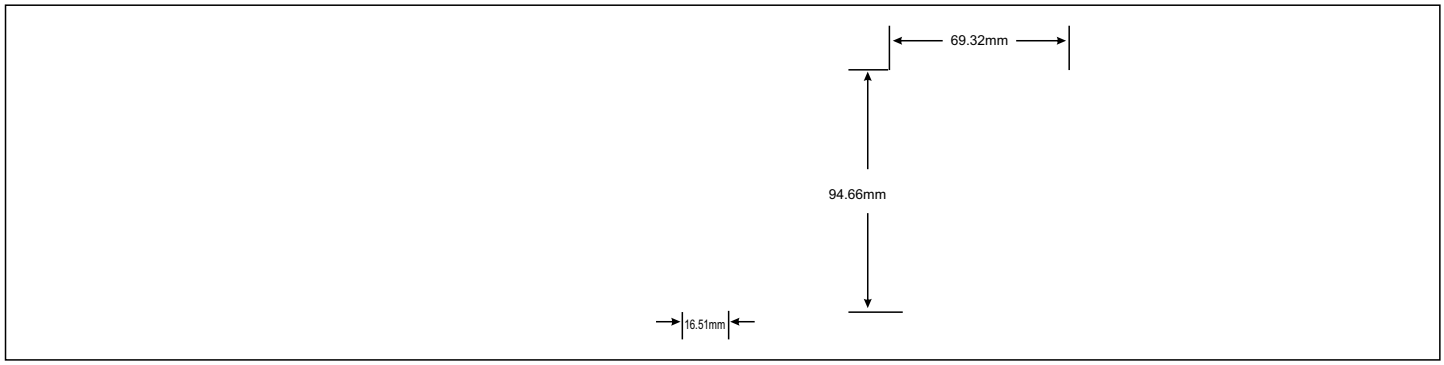

Fig.10.1 Keypad dimension

3URGXFW GLPHQVLRQ

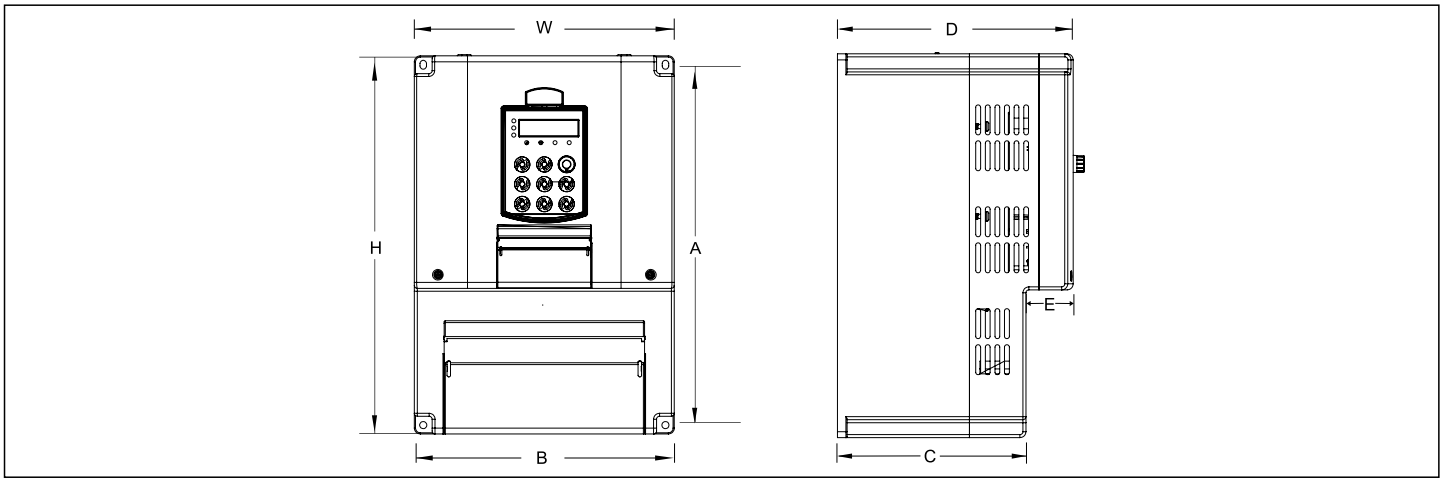

Fig.10.2 Product dimension

[redacted]	0RXQWLQJ GLPHQVLRQ			'LPHQVLRQ				3RUH GLDPHWHU	. HLJKW
	$ PP	% PP	& PP	+ PP	: PP	' PP	(PP	PP	NJ
	240	148	133.5	247	160	173	39.5	10	2.97
									3.08
									3.19
	305	205	157	320	220	196.5		10	6.30
									6.46
									6.62

5HFRPPHQGHG [redacted]]HV

While operating the drive, all connections must be neat and tight. For this, it is recommended to connect the input and output wires to the drive along with the lugs. As per the terminals sizes the recommended lugs are as follows:

[redacted]

Heavy

5HFRPPHQGHG ZLUH JXDJHV

UHV

*AWG – American wire gauge