VELRON VCD100 Series

Operating Manual

Frequency Inverter with Vector Control



Version 1.0 - Translated Original Manual

As of October 2026

www.velron.de

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1. About this Operating Manual

1.1 Preface

Dear user,

with the Velron VCD100 frequency inverter you have purchased a compact device for speed control of three-phase motors. This operating manual guides you step by step from the safety instructions through installation, wiring and commissioning to the detailed description of all parameters and troubleshooting.

Always observe the safety instructions in chapter 2 and the warnings in the individual chapters.

If you have any questions or if questions arise during operation of the frequency inverter, please contact:

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All information in this manual has been compiled to the best of our knowledge and with the greatest care at the time of printing; however, we cannot guarantee that it is free of errors. Mecheltron GmbH & Co. KG accepts no liability for any errors or mistakes that may be derived from this manual or the products described in it.
Mecheltron GmbH & Co. KG expressly reserves the right to make changes and modifications within the scope of the statutory provisions and to improve the product properties.

1.2 Symbols, Terms and their Meaning

The following safety notes and symbols are used throughout this operating manual and on the device:

	General note or Note on minor property damage to the device, no personal injury.
	General warning
	Danger from electrical voltage
	Serious property damage and minor personal injury.
	Serious property damage, serious or fatal personal injury – "danger to life"!

1.3 Contents and Storage of the Operating Manual

	**Always keep the operating manual with the frequency inverter! The manual must always be at hand!**

This operating manual familiarizes the operator and the qualified personnel with the Velron VCD100 frequency inverter. It contains:

- safety instructions
- technical data
- installation and electrical connection
- operation and commissioning
- description of all parameters
- troubleshooting, dismantling and disposal

Read this manual carefully before installing and commissioning the frequency inverter. It describes proper and safe operation – in particular, the warnings must be observed and the applicable local accident prevention regulations and general safety regulations must be complied with.
The operating manual is part of the product and must be kept accessible at all times near the frequency inverter (e.g. at the control cabinet).
If the frequency inverter or the machine in which it is installed is passed on or sold, the operating manual must be handed over with it.

1.4 Liability and Warranty

All information in this manual has been compiled to the best of our knowledge and in accordance with the state of the art. Mecheltron GmbH & Co. KG is not liable for personal injury or property damage caused by use other than the intended use, improper handling, failure to observe the manual – in particular the warnings it contains –, insufficiently qualified personnel, unauthorized modifications to the device or failure to observe locally applicable safety regulations.

The frequency inverter is a component intended for installation in electrical systems or machines. The installer or the machine manufacturer is responsible for the safe design of the complete system (e.g. emergency stop, protective devices, EMC-compliant installation).

The illustrations in text and pictures may differ from the scope of delivery where a symbolic illustration is sufficient. The pictures are not drawn to a uniform scale. Special designs, optional equipment or important technical changes may lead to deviations from the described scope of delivery, illustrations, information and notes.

We reserve the right to make technical changes that serve to improve the performance characteristics and further development. The warranty period is regulated by law.

If you have any questions, we will be pleased to advise you by telephone, by e-mail or, by appointment, in person.

1.5 Copyright

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Subject to technical changes.

1.6 Target Group and Qualification of Personnel

- Reading and understanding this operating manual is a prerequisite for all work with the frequency inverter.
- Installation, electrical connection, commissioning, maintenance and troubleshooting may only be carried out by qualified electricians who are familiar with the design, installation and operation of frequency inverters and who know the relevant safety regulations.
- When advice is requested, Mecheltron GmbH & Co. KG assumes that the content of the manual is known.
- In commercial use, every person working on or with the frequency inverter must have read and understood the manual – even if experienced with similar devices or after training.
- The knowledge provided in this manual is a prerequisite for protecting personnel from hazards, avoiding errors and ensuring safe and trouble-free operation.



In commercial use, it is recommended that the operator has every person working with the frequency inverter confirm in writing and with signature that they have carefully read the contents of this manual.

1.7 Scope of Delivery and Inspection upon Receipt



Inspect the frequency inverter for transport damage when unpacking and compare the nameplate with your order (see chapter 2.2).
Damaged devices must not be installed or put into operation!

1.8 Operating Personnel



The frequency inverter may only be operated by instructed persons. Installation, electrical connection, commissioning and troubleshooting are reserved for qualified electricians. Parameters may only be changed by qualified personnel who can assess the effects on the connected machine; password protection can be set up with PP.00.

1.9 Service Life

An exact statement of the service life is not possible, as it depends on the operating conditions such as load, ambient temperature, humidity, dust and duty cycle. Good ventilation and compliance with the ambient conditions (see chapter 4.1) have a positive effect on the service life.

1.10 Safety Regulations – Overview (for details see chapter 2.)

The Velron VCD100 frequency inverter is designed for speed control of three-phase motors (intended use see chapter 2.4). Observe in particular:



FAILURE TO OBSERVE THE FOLLOWING REGULATIONS MAY RESULT IN SERIOUS INJURY AND PROPERTY DAMAGE

- For your own safety, read this operating manual before commissioning, in particular chapter 2 "Safety Precautions".
- Work on the frequency inverter may only be carried out by qualified electricians.
- Before working on the device, switch off the mains voltage and wait at least 10 minutes until the DC bus capacitors have discharged.
- Even when the motor is at standstill, dangerous voltage may be present at terminals L1, L2, L3 and U, V, W.
- Always ground the frequency inverter properly.
- Damaged devices must not be installed or operated.

2. Safety Precautions

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2.1 Informal safety measures "Operating instructions"

Please read this operation manual carefully before installation, operation, maintenance or inspection In this manual, the safety precautions were sorted to – “WARNING” or “DANGER”.

WARNING	Indicates a potentially dangerous situation which, if can not avoid will cause minor or moderate injury and damage the device. This Symbol is also used for warning any un-safety operation.
DANGER	Indicates a potentially dangerous situation which, if cannot avoid will result in death or serious injury.
In some cases, even the contents of "WARNING" still can cause serious accident. Please follow these important precautions in any situation.	
	Indicate the necessary operation to ensure the device run properly. Warning marks are placed on the front cover of the frequency inverter. Please follow these indications when using the frequency inverter.

DANGER	• Risk of Injury and electric shock. • Read the manual and follow the safety instruction before use. • Isolate from supply and wait 10 minutes before removing this cover. • Ensure proper earth connection. • Mount the inverter on a non-combustible surface.

2.2 Inspection

WARNING	Do not install or use any inverter that is damaged or have fault part; otherwise may cause injury.

Check the following items when unpacking the frequency inverter:
(1) Inspect the entire exterior of the frequency inverter to ensure there are no scratches or other damage caused by the transportation. (2) Ensure that the quick start guide is included in the delivery. (3) Inspect the nameplate and ensure it is what you ordered. (4) Ensure the optional parts are what you need if have ordered any optional parts.
Please contact your local agent if there is any damage to the frequency inverter or optional components.

2.3 Installation and disassemble warning

DANGER

- The person without passing the training manipulate the device or any rule in the "Warning" being violated, will cause severe injury or property loss. Only the person, who has passed the training on the design, installation, is permitted to operate this equipment.
- Input power cable must be connected tightly, and the equipment must be grounded securely.
- Even if the inverter is not running, the following terminals still have dangerous voltage:
  - Power terminals L1, L2, L3
  - Motor connection terminals U, V, W
- When power off, should not install the inverter until 10 minutes after, which can ensure the device discharge completely.
- The section area of grounding conductor must no less than 10 mm², or according to below data, select the maximum value of the two as the grounding conductor area:

Power supply cable area of conductor S in mm²	Area of grounding conductor
S ≤ 16	S
16 < S ≤ 35	16
35 < S	S / 2

WARNING

When moving the frequency inverter please lift by its base and don't lift by the panel, otherwise may cause the main unit fall off which may result in personal injury.

- Install the inverter on the fireproofing material (such as metal) to prevent fire.
- When need install two or more inverters in one cabinet, cooling fan should be provided to make sure that the air temperature is lower than 40°C, otherwise it could cause fire or damage the device.

2.4 Intended Use

2.4.1 Intended Application

The Velron VCD100 frequency inverter is intended for speed control of three-phase asynchronous motors.
It is designed for installation in a control cabinet or in a machine (degree of protection IP20) and may only be operated indoors under the conditions stated in chapter 3 and chapter 4.1.
It is connected to a single-phase 230 V AC, 50/60 Hz supply. A three-phase 230 V AC motor of suitable power is connected to the output (see chapter 3.3).
Intended use also includes observing this operating manual, in particular the safety instructions.
Any other use is considered improper.

2.4.2 Operating Limits

Mains voltage: single-phase 230 V AC, 50/60 Hz
Motor power: at most the rated power of the device (0.75 kW, 1.5 kW or 2.2 kW depending on the model)
Ambient temperature: -10 °C to 40 °C (40 °C to 50 °C only with derating)
Humidity: below 95% relative humidity, non-condensing
Altitude: up to 1000 m (above only with derating)
Motor cable: normally shorter than 30 m (see chapter 4.3)

2.5 Foreseeable Misuse



Note:
The following list is not exhaustive. The examples given are intended to convey an idea of what dangerous misuse may consist of.

- Failure to observe the operating manual
- Operation outside the technical data (mains voltage, current, power, ambient conditions)
- Applying the mains voltage to the output terminals U, V, W
- Interference suppression capacitors, RC elements or similar snubbers at the output of the frequency inverter
- Operation without proper protective earthing
- Working on the device before the discharge time of 10 minutes after switch-off has elapsed
- Using the STO function for isolation – STO does not disconnect the mains voltage
- Operation outdoors, in a damp, dusty or corrosive environment or with covered ventilation openings
- Modifications or conversions of the device without consulting the manufacturer
- Use of unsuitable spare parts
- Operation of damaged devices
- Repeatedly resetting faults without eliminating the cause
- Ignoring damage or signs of wear

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3.1 Technology Features

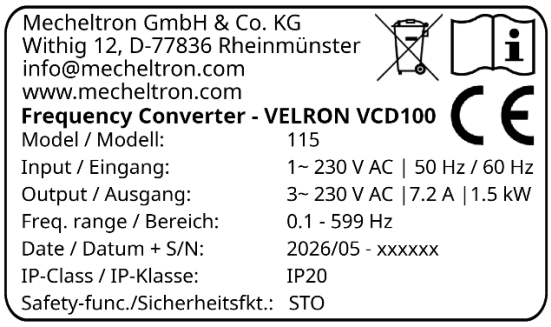
	ITEM	Technical specification VCD100
Basic function	Maximum output frequency	Vector control: 0 - 599Hz V/F control: 0 - 599Hz
	Carrier frequency	0.5kHz - 16kHz The carrier frequency can be automatically adjusted based on the load features.
	Input frequency resolution	Digital setting: 0.01Hz Analog setting: maximum output frequency x 0.025%
	Control mode	Voltage / Frequency control (V/F) Sensorless vector control (SVC - No pulse generator) Closed loop vector control (CLV - Have pulse generator)
	Startup torque	G Type: 0.5Hz / 150% (No PG) 0Hz / 180% (Have PG) P Type: 0.5Hz / 100%
	Speed range	1: 100 (No PG) 1: 1000 (Have PG)
	Speed control accuracy	± 0.5% (No PG) ± 0.02% (Have PG)
	Speed fluctuation	± 0.2% (No PG) ± 0.06% (Have PG)
	Overload capacity	G Type: 60s for 150 % of the rated current, 3s for 180 % of the rated current. P Type: 60s for 120 % of the rated current, 3s for 150 % of the rated current
	Torque boost	Fixed boost Customized boost 0.1% - 30.0%
	V/F curve	Straight-line V/F curve Multi-point V/F curve N-th Power V/F curve (1.2-power, 1.4-power, 1.6-power,1.8-power, square)
	V/F Separation	Two types: complete separation, half separation
	Ramp Mode	Straight-line ramp S-curve ramp Four groups of acceleration / deceleration time with the range of 0.0 - 6500.0s
	DC braking	DC braking frequency: 0.00 Hz to maximum frequency Braking time: 0.0 - 100.0s Braking action current value: 0.0% - 100.0%
	JOG control	JOG frequency range: 0.00Hz - 50.00Hz. JOG acceleration / deceleration time: 0.0s - 6500.0s.
	Onboard Multiple Preset Speeds	Up to 16 preset speeds can be implemented using the built-in simple PLC function or via digital input terminal states.

	ITEM	Technical specification VCD100
Basic function	Onboard PID	It enables easy implementation of process-controlled closed-loop systems.
	Auto voltage regulation (AVR)	It can keep constant output voltage automatically when the mains voltage changes.
	Over-voltage/ Over-current stall protection	The current and voltage are limited automatically during the running process so as to avoid frequent tripping due to over-voltage/over-current
	Fast Current Limiting (FCL)	This prevents frequent overcurrent faults in the inverter.
	Torque Limiting and Torque Control	It automatically limits the torque and prevents frequent overcurrent tripping during operation.
	Protection modes	Motor short-circuit detection at power-on, input/output phase loss protection, overcurrent protection, overvoltage protection, undervoltage protection, overheat protection, and overload protection.
	Safe Torque Off (STO)	Dual-channel safety function STO according to IEC 61800-5-2 via inputs STO1 and STO2. Safely switches off the motor torque, stop category 0 according to IEC 60204-1. STO does not disconnect the mains voltage.
Individualized function	High performance	Asynchronous motor control is implemented using high-performance current vector control.
	Instantaneous Stop Failure	The regenerative energy from the load compensates for the voltage drop, allowing the AC drive to ride through short-term power interruptions.
	Timing control	Timing range 0.0min - 6500.0min
	Communication methods	Integrated RS-485 (Modbus RTU). CAN (CANopen), Profibus DP, EtherCAT and Modbus TCP via optional expansion cards.
Operation	Run Command Channel	Flexible command source switching: Via keypad, control terminals, or serial communication port.
	Frequency Reference Source	Flexible reference switching: 10 frequency sources available, including digital input, analog voltage/current, pulse trains, and serial communication.
	Auxiliary Frequency Reference Source	Ten auxiliary frequency sources enable precise fine-tuning and frequency reference synthesis.
	Input terminals	5 digital inputs, including one high-speed pulse input (up to 100 kHz). 1 analog input (selectable 0–10 V voltage or 0–20 mA current input).
	Output terminals	1 digital output 1 relay output 1 analog output (0–10 V voltage or 0–20 mA current output)

	ITEM	Technical specification VCD100
Operation panel	LED/LCD Display	Displays parameters and operating status.
	Key lock and function selection	It allows partial or complete locking of the keypad and enables customization of key functions to prevent accidental or unauthorized operation.
Environment	Installation location	Indoor installation only. Protect from direct sunlight, dust, corrosive or combustible gases, oil mist, steam, dripping water, and salt spray.
	Altitude	Below 1000 m (Derating required for altitudes above 1000 m).
	Ambient temperature	-10°C to 40°C (Derating required if the ambient temperature is between 40°C and 50°C).
	Humidity	Below 95% RH, non-condensing.
	Vibration	Below 5.9 m/s² (0.6g)
	Storage temperature	-20°C to +60°C
	Enclosure Rating	IP20

3.2 Nameplate Description

3.2.1 Nameplate



3.2.2 Model Code / Type Code

VCD100 - 1 15

VFD - Series

Power	
07	0.75 kW
15	1.5 kW
22	2.2 kW

Voltage class	
1	1~ 230 VAC
3	3~ 400 VAC

3.2.3 Electrical Data

Nameplate details	Description
Input / Eingang	Mains Voltage (Connection Voltage) | Connection Frequency
Output / Ausgang	Output Voltage | Output Current | Output Power
Freq. Range / Bereich	Output Frequency Range
Date / Datum + S/N	Production Date + Serial number
IP-Class / IP-Klasse	Enclosure Rating
Safety-func. / Sicherheitsfkt.	Installed Safety function, for example STO

3.3 Selection Guide

ITEM / Model	VCD100 - 107	VCD100 - 115	VCD100 - 122
Rated Input Voltage	1PH 230 VAC 50 / 60 Hz	1PH 230 VAC 50 / 60 Hz	1PH 230 VAC 50 / 60 Hz
Rated Input Current	7.2 A	10.0 A	16.0 A
Output Frequency Range	0.1 - 599 Hz	0.1 - 599 Hz	0.1 - 599 Hz
Rated Output Voltage	3PH 230 VAC	3PH 230 VAC	3PH 230 VAC
Rated Output Current	3.8 A	7.2 A	9.0 A
Rated Output Power	0.75 kW	1.5 kW	2.2 kW
Recommended Motor Power	0.75 kW	1.5 kW	2.2 kW
Control mode	Voltage / Frequency control (V/F) Sensorless vector control (SVC - No pulse generator) Closed loop vector control (CLV - Have pulse generator)		
STO Function (Safe Torque Off)	Yes	Yes	Yes
EMC Filter	Yes - Built in	Yes - Built in	Yes - Built in
Ambient Temperature	-10°C to 40°C	-10°C to 40°C	-10°C to 40°C
Recommended Braking Resistor	150 Ω / ≥ 80 W	100 Ω / ≥ 100 W	70 Ω / ≥ 100 W

4. Installation and Wiring

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4.1 Environment and Installation Requirements

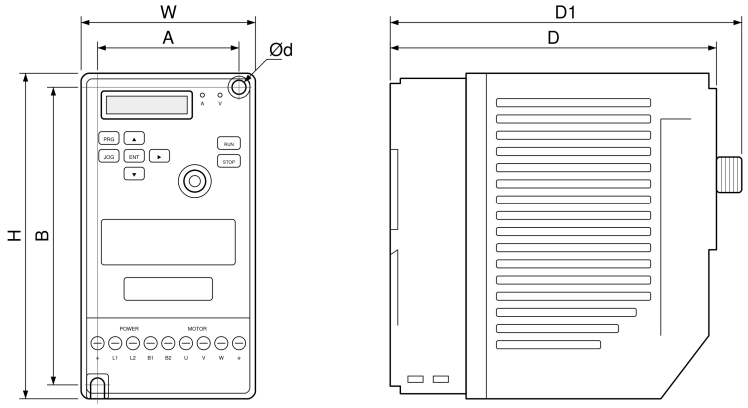
The installation environment of the AC drive directly impacts its service life and operational reliability. If the ambient conditions do not meet the specified requirements, it may result in malfunctions, protective tripping, or permanent damage to the drive.

The VCD100 series is a wall-mounted drive and must be installed vertically to ensure optimal air convection and effective heat dissipation.

Please ensure that the installation environment strictly complies with the following requirements:

(1) Ambient temperature between -10°C and +40°C.
(2) Relative humidity between 0% and 95%, non-condensing.
(3) Avoid direct sunlight.
(4) Environment must be free from corrosive gases and liquids.
(5) Environment must be free from dust, floating fibers, lint, and metallic particles.
(6) Keep away from radioactive materials and fuels.
(7) Keep away from sources of electromagnetic interference (e.g., welding machines, high-power equipment).
(8) Install on a flat, solid surface free of vibration. If vibration cannot be avoided, install anti-vibration pads to reduce the mechanical stress.
(9) Install the drive in a well-ventilated area that is easily accessible for inspection and maintenance. Mount it exclusively on solid, non-combustible material and away from heating elements (e.g., braking resistors).
(10) Ensure sufficient clearance around the drive. When installing multiple units, ensure proper placement/alignment and install additional cooling fans to keep the ambient temperature below 45°C.

4.2 Outline Dimensions and Installation Sizes

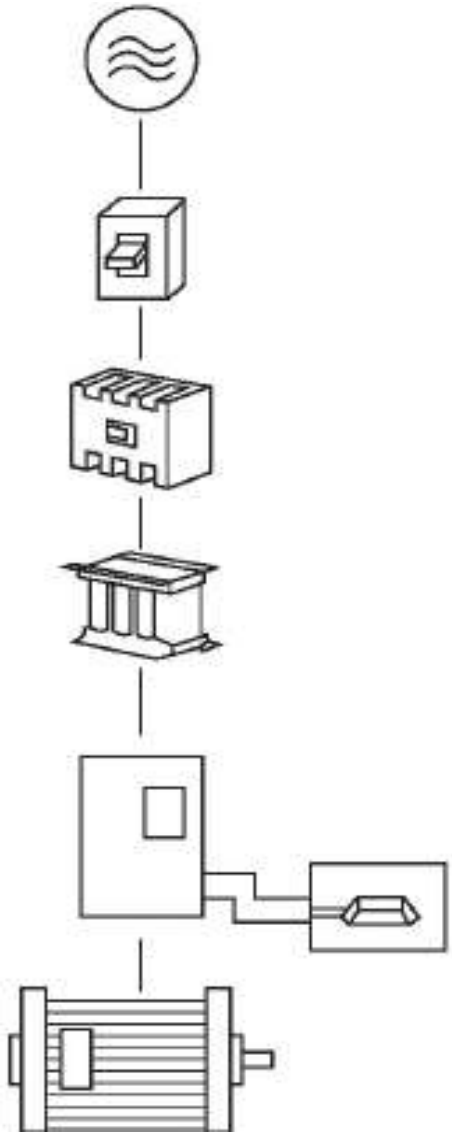


	Dimensions (mm)				Installation Dimensions (mm)		
Model	**W**	**H**	**D**	**D1**	**A**	**B**	**Ø d**
VCD100 - 107	69	129	129	139	56	118	5.5
VCD100 - 115	69	129	129	139	56	118	5.5
VCD100 - 122	109	129	133	143	96	118	5.5

Standard 35 mm DIN rail mounting is supported.

4.3 Frequency Inverter Wiring

4.3.1 Main Circuit Wiring



Power supply: Please use a power supply that meets the allowable specifications of the AC drive.

Air switch: Use a Moulded Case Circuit Breaker (MCCB) or Residual Current Circuit Breaker (RCCB). When power is turned on, a high inrush current flows into the drive. Please select the circuit breaker carefully based on this current.

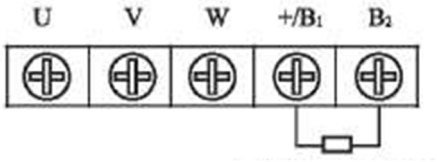
Contactor: Magnetic Contactor (MC). Note: Do not use the electromagnetic contactor to start and stop the AC drive, as this will significantly reduce the service life of the device.

AC reactor: Optional. Used to suppress high harmonics and improve the power factor. Please select a suitable reactor based on the specifications.

Braking resistor: Enhances the braking capacity of the AC drive's integrated brake unit.

4.3.2 Descriptions of Peripheral Devices

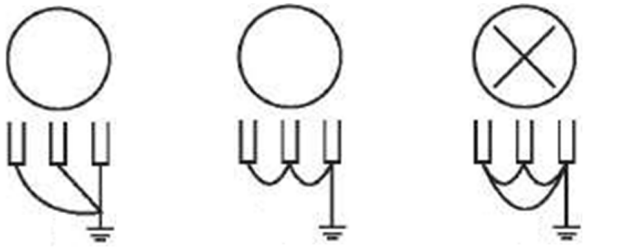
(1) AC Power Supply: Use a power supply that meets the allowable specifications of the AC drive.
(2) Moulded Case Circuit Breaker (MCCB): Provides protection in the event of low supply voltage or a short circuit at the input terminals. The breaker can also be opened during inspection and maintenance, or when the drive is not in operation, to safely isolate the AC drive from the power supply.
(3) Magnetic Contactor (MC): Used to switch the main power supply of the AC drive on and off to ensure system safety.
(4) AC Reactor:
  a) Suppresses high-order harmonics to protect the AC drive and ensure safe operation.
  b) Improves the power factor.
(5) Braking Resistor: Dissipates regenerative energy during motor braking to prevent overvoltage on the DC bus and enhances the braking performance of the integrated brake unit. (For the braking resistor connection diagram, see below).



Braking Resistor

4.3.3 Main Circuit Wiring Precautions

(1) Main circuit wiring must comply with all local and national electrical codes.
(2) Applying input power to the output terminals (U, V, W) will cause severe damage to the AC drive. Never perform such miswiring.
(3) Use insulated wires for power supply connections and route them through conduits where possible. Ensure all metal conduits and protective grounds are properly bonded to the earth.
(4) The AC drive must not share a common ground cable with welding equipment, high-power motors, or other high-power inductive loads.
(5) The ground terminal (E) must be properly connected to the protective earth conductor.
(6) Keep the grounding cables as short as possible.
(7) When grounding multiple AC drives, ensure that no ground loops are created. Refer to the correct grounding configuration diagram below.

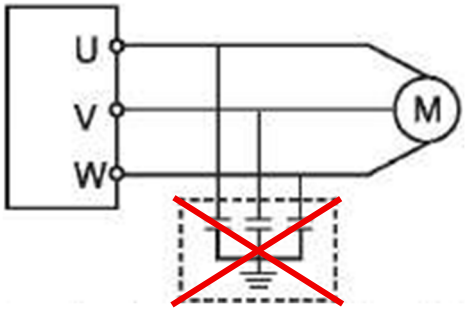


Correct Correct Incorrect (Ground Loop)

(8) Power cables and control cables must be routed separately from the main circuit. Maintain a minimum distance of 10 cm when running power cables and control cables in parallel. If power cables and control cables must cross each other, ensure they cross at a 90-degree vertical angle. Never bundle power and control cables together, as the resulting electromagnetic interference will cause system malfunctions.

(9) Under normal circumstances, the cable distance between the AC drive and the motor should be less than 30 m. High-frequency leakage currents caused by parasitic capacitance in long cables can trigger overcurrent protection, unintended actions, drive faults, or equipment operating errors. The maximum allowable distance is 100 m. For long cable distances, an output filter must be installed and the carrier frequency must be reduced.

(10) Do not install surge absorbing capacitors, RC snubbers, or other capacitance-resistance absorbing devices at the output side of the AC drive.



No RC snubbers, etc. at the output

(11) Ensure all terminals are tightened securely and all cables are properly connected. This prevents loose connections caused by vibration or shaking, which could lead to arcing, sparking, or short circuits.

(12) To minimize electromagnetic interference, it is recommended to install surge absorbers on all adjacent contactors and relays.

4.3.4 Recommended Device Specifications

Model	Motor Power	Main Circuit Cable Cross-Section	Circuit Breaker	Magnetic Contactor
	(kW)	(mm²)	(A)	(A)
VCD100 - 107	0.75	0.75	16	12
VCD100 - 115	1.5	1.5	25	18
VCD100 - 122	2.2	2.5	32	25

*The above data is for reference only.

4.3.5 Recommended Braking Resistors

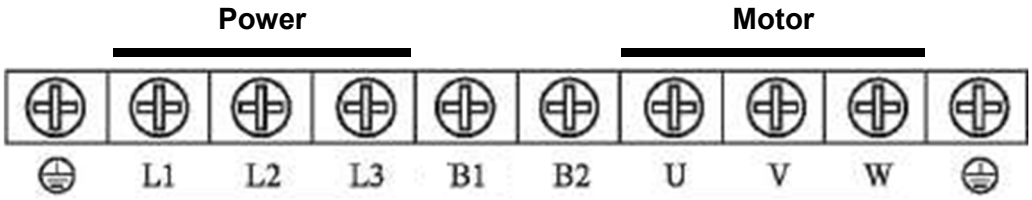
	Braking resistor	
Model	**Power W**	**Resistance Ω**
VCD100 - 107	≥ 80 W	150 Ω
VCD100 - 115	≥ 100 W	100 Ω
VCD100 - 122	≥ 100 W	70 Ω

Note:
If a braking resistor is used, P9.03 (overvoltage stall gain) and P2.08 (vector control over-excitation gain) must be set to 0.

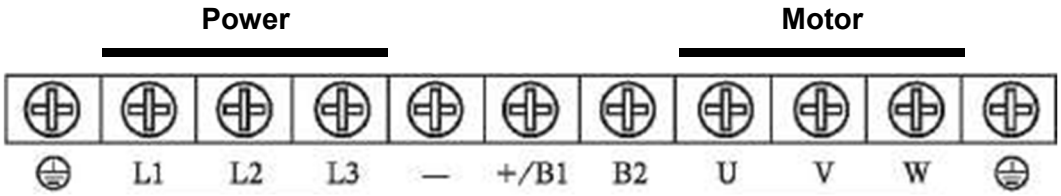
4.3.6 Main Circuit Terminals and Descriptions

1. Arrangement of main circuit terminals

   a) 1PH 230 V AC 0.4 – 1.5 kW (VCD100-107, VCD100-115)



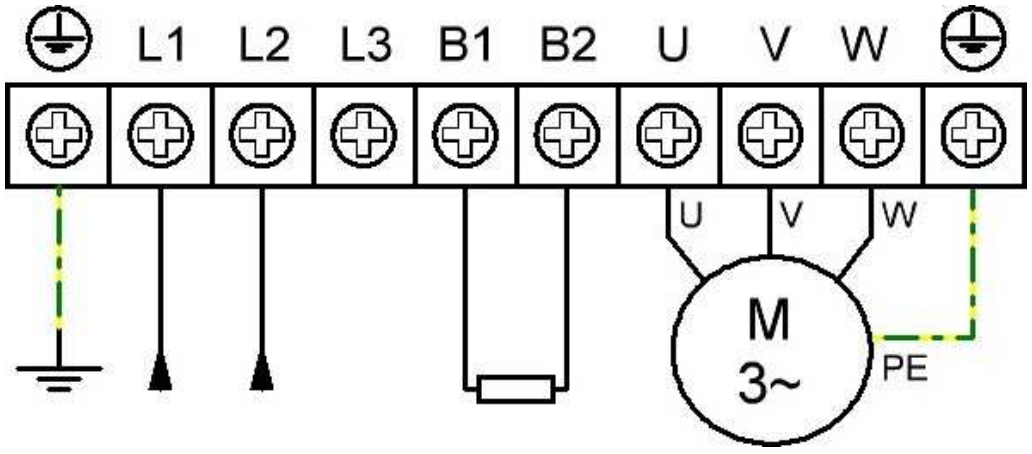
   b) 1PH 230 V AC 2.2 kW (VCD100-122)



2. Description of main circuit terminals

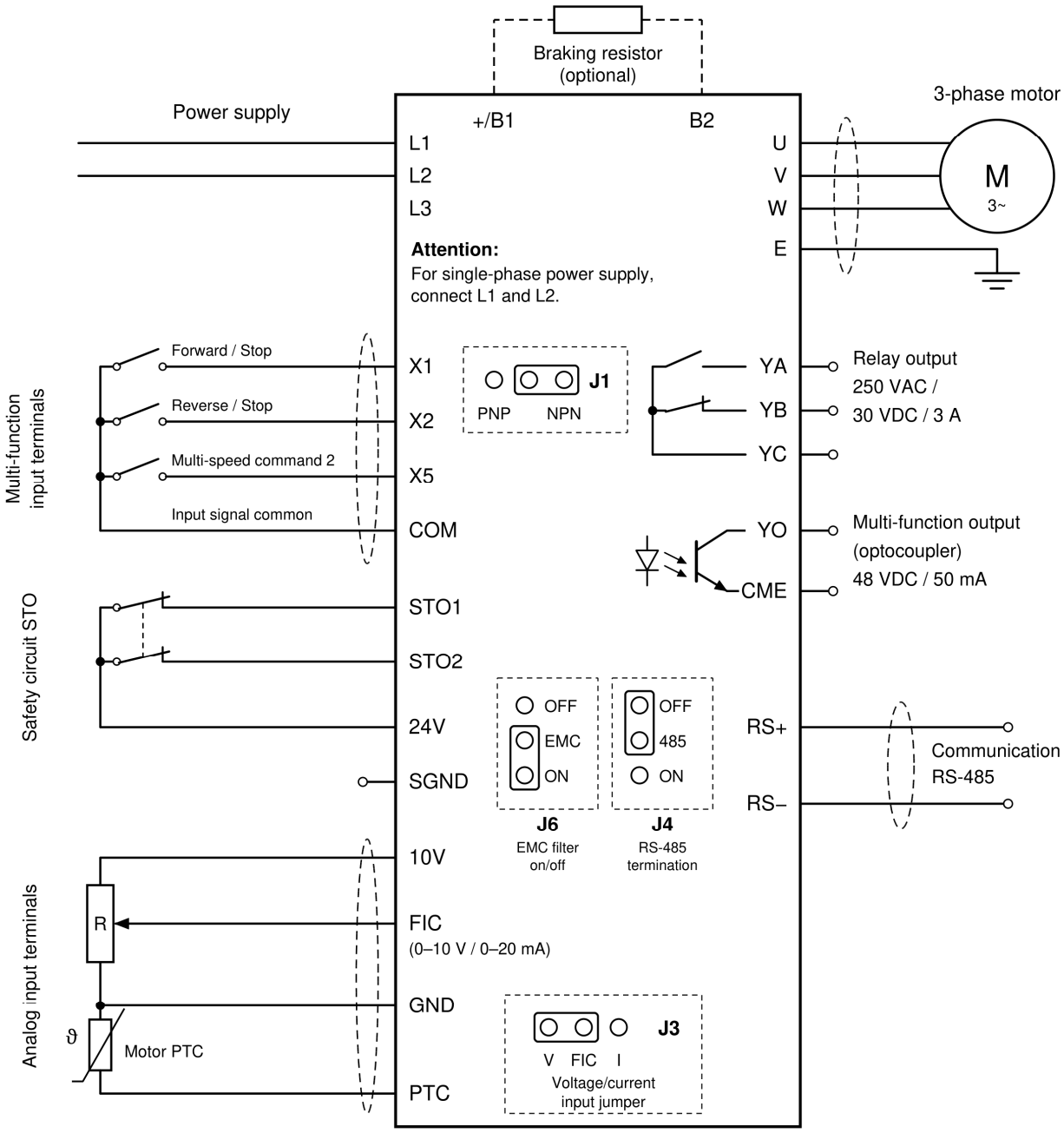
Terminal Name	Description
⏚	Protective Earth (PE) ground connection
L1, L2, L3	Main circuit power supply input
U, V, W	Output connection to a three-phase AC motor
+/B1, B2	Connection for an external braking resistor

3. Wiring example of main circuit



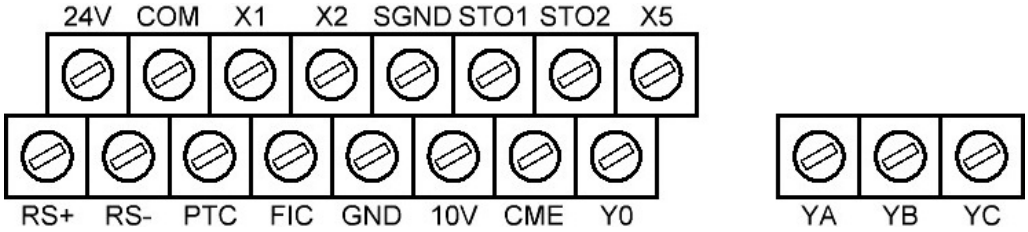
Power supply input Braking resistor Motor

4. Basic Wiring Diagram



4.3.7 Control Terminals

1. Arrangement of control terminals



2. Description of control terminals

Terminal Name	Function Description	Remarks
24V	+24 V auxiliary power supply	Internal +24 VDC power supply for the STO inputs
COM	Digital input common terminal	Common reference for digital inputs. NPN/PNP logic selectable via jumper JP1. Factory setting: NPN logic
X1	Forward run command input (multi-function input terminal)	Terminals X1, X2 and X5 can be configured via parameters P4.00 to P4.05. The terminal is active when closed to COM
X2	Reverse run command input (multi-function input terminal)	
X5	Multi-speed command 2 (High-speed pulse input)	
SGND	Reference potential of the 24 V control power supply	Reference potential for the STO inputs
STO1	Safe Torque Off input 1	Dual-channel safety input (Safe Torque Off) to safely prevent accidental motor restart
STO2	Safe Torque Off input 2	
RS+ / RS-	RS485 interface	Serial communication port
PTC	Motor thermistor input (PTC)	Connection for motor temperature monitoring via a PTC thermistor
FIC	Analog input terminal (Current/Voltage)	Input range: 0–10 V / 0–20 mA
GND	Analog input signal common	Reference ground for analog signals
10V	Frequency setting power supply	Internal +10 VDC reference voltage for external potentiometer

Terminal Name	Function Description	Remarks
CME	Optocoupler output common terminal	The function of the digital transistor/optocoupler output can be configured via parameter P5.04
Y0	Multi-function optocoupler output	
YA	Relay output contact (Normally Open) Closes the contact to YC when the programmed relay function is active	The function of the relay output contacts can be configured via parameter P5.02
YB	Relay output contact (Normally Closed) Opens the contact to YC when the programmed relay function is active	
YC	Common relay output terminal for the relay outputs (YA and YB)	

4.3.8 Control Circuit Wiring Notes

(1) Route all control signal lines strictly separate from main circuit lines and other power cables.
(2) To prevent malfunctions caused by electromagnetic interference, use twisted-pair or double-shielded cables with wire specifications between 0.3 and 0.5 mm².
(3) Ensure that the operational parameters of all connected devices comply with the maximum allowable terminal ratings, such as voltage limits and maximum current capacities.
(4) Properly ground the earth terminal E.
(5) Comply with the specific wiring requirements of each terminal and ensure the correct selection of peripheral accessories, such as potentiometers, voltmeters, and input power supplies.
(6) After completing the wiring, thoroughly inspect all connections to ensure accuracy before turning on the power supply.

4.4 Control Board Jumper Descriptions

Switch Label	Function Description	Remarks
J1	NPN / PNP logic selection switch	Selects between sink (NPN) and source (PNP) logic for the digital inputs.
J3	Analog input FIC configuration switch	**V:** voltage input **I:** current input
J4	RS485 communication terminal resistor switch	**ON:** Connects a 120 Ω terminal resistor in parallel between RS+ and RS-. **OFF:** No termination resistor is connected.
J6	EMC filter selection switch (filter ground connection on/off)	**ON:** Connects the internal EMC filter to ground. **OFF:** Disconnects the EMC filter from ground (required for operation on IT networks).

5. Operation

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5.2.2 Fault Reset 31
5.2.3 Motor Parameter Auto-Tuning 32
5.2.4 Restoring Factory Settings 32

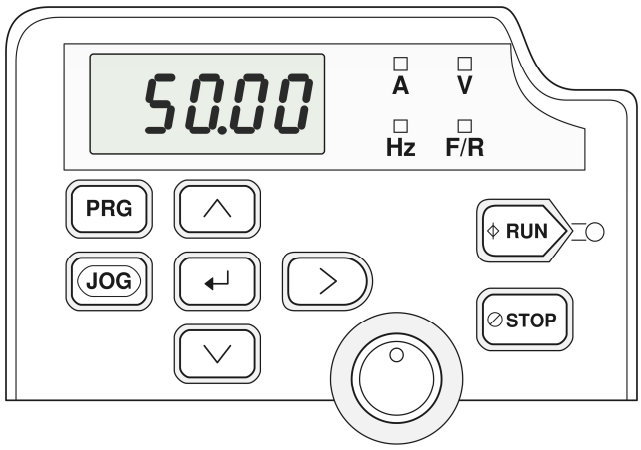
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5.1 Digital Operator Description

The digital operator can also be referred to as the keypad or control panel.

5.1.1 Control Panel Layout



5.1.2 Key Function Descriptions

Key	Name	Description
PRG	Programming / Escape key	Enters or exits the first-level menu, or deletes shortcut parameters.
↵	Data enter key	Enters the menu levels progressively and confirms parameter settings.
∧	UP / Increment key	Progressively increases data values or function codes.
∨	DOWN / Decrement key	Progressively decreases data values or function codes.
JOG	Quick multi-function key	The function of this key is defined by function code P7.01.
>	Right shift key	In parameter setting mode, press this button to select the digit to be modified. In other modes, it cyclically shifts right to display different monitoring parameters.
RUN	RUN key	Starts the AC drive when the run command channel is set to keypad control.
STOP	STOP / Fault reset key	In running status, this key can be used to stop the AC drive (restricted by parameter P7.04). In a fault alarm state, it resets the drive without restriction.
	Digital potentiometer / Encoder	When P0.03=4, rotating the knob modifies the set frequency. In standby or running mode, pressing the knob cyclically switches the display parameters (output frequency, output current, output voltage, DC bus voltage, or output speed) based on settings P7.03 to P7.05.

5.1.3 Status Indicator Descriptions

Indicator Name	Description
Hz	Frequency unit indicator.
A	Current unit indicator.
V	Voltage unit indicator.
F/R	Direction indicator. LED off: Forward operation. LED on: Reverse operation.

5.2 Operation Processes

5.2.1 Parameter Setting

Modifying parameters is performed using a three-level menu structure:
1. The function code group (First-level menu)
2. The function code identifier (Second-level menu)
3. The function code set value (Third-level menu)

Menu Operation Notes

During three-level menu operations, you can press either the PRG key or the ↵ key to return to the second-level menu. The difference between the two is as follows:

Pressing the ↵ key saves the modified parameter value in the control panel, returns to the second-level menu, and automatically advances to the next function code.

Pressing the PRG key returns directly to the second-level menu without saving the modified parameter value, and the display remains on the current function code.

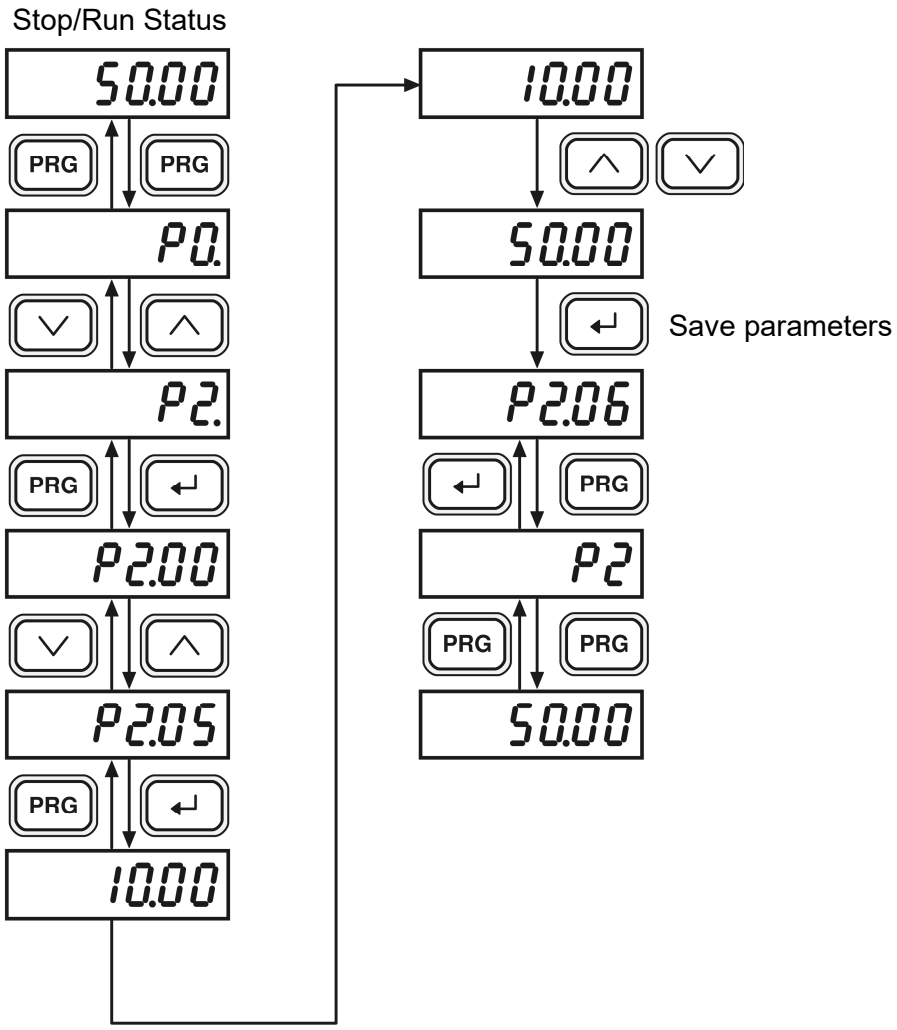
Parameter Modification Restrictions

In the third-level menu state, if the parameter value does not flash, it indicates that the function code cannot be modified. The possible reasons are:

(1) The function code belongs to read-only parameters that cannot be modified, such as actual monitoring parameters, operational records, or status data.

(2) The function code cannot be modified while the AC drive is running and requires the drive to be stopped before modification is allowed.

Example
Change the function code **P2.05** from a setting of 10.00 Hz to 50.00 Hz.



5.2.2 Fault Reset

After a fault occurs, the AC drive will display the relevant fault information. Users can press the STOP key on the keypad or use a configured digital input terminal (configured via group P4) to execute a fault reset.
Once reset, the AC drive returns to the standby state. If the AC drive remains in a fault state and the user does not perform a fault reset, the drive stays in fault protection mode and cannot be started.

5.2.3 Motor Parameter Auto-Tuning

Rotational Auto-Tuning
When selecting sensorless vector control (SVC), the entered motor nameplate parameters must be highly accurate so that the AC drive can precisely match the standard motor characteristics. To achieve optimal control performance, motor parameter auto-tuning is strongly recommended. The steps for rotational auto-tuning are as follows:
First, set the run command channel selection parameter (P0.02) to keypad control.
Then, input the following parameters according to the specifications on the motor nameplate:
P1.01: Motor rated power
P1.02: Motor rated voltage
P1.03: Motor rated current
P1.04: Motor rated frequency
P1.05: Motor rated speed

Then start the auto-tuning:
1. Set parameter **P1.37** to **2** (rotational auto-tuning) and confirm with **ENTER**. The display shows **Study**.
2. Press **RUN**. The auto-tuning begins and the motor is started.
3. After successful completion, the AC drive saves the determined motor data (P1.06 to P1.10). The display returns to the monitoring display and shows the current frequency.

If the auto-tuning is aborted with fault **TE**, check the motor data (P1.01 to P1.05) and the motor cable (see chapter 8.1).
Please refer to the detailed descriptions provided for function code P1.37 (see page 50).



Note:
During the rotational auto-tuning process, the motor shaft must be completely decoupled from the load. Otherwise, the motor parameters calculated by the drive may be incorrect.

Static Auto-Tuning
During static motor parameter auto-tuning, it is not necessary to decouple the motor from the mechanical load. Before starting, the motor nameplate parameters (P1.01 to P1.05) must be entered correctly. This auto-tuning mode measures the motor stator resistance, rotor resistance, and leakage inductance. However, the mutual inductance and the no-load current cannot be measured statically. The user can manually input these corresponding values based on the motor data sheet.
The procedure is the same as for rotational auto-tuning, but with **P1.37 = 1**. The motor does not rotate.

5.2.4 Restoring Factory Settings

Parameter PP.01 (parameter initialization) resets the AC drive to the factory settings. The motor parameters, the fault records, the accumulative running time (P7.09), the accumulative power-on time (P7.13) and the accumulative power consumption (P7.14) are retained (see chapter 6.14). All other parameters set for the application are lost. Note down the changed parameters beforehand so that you can enter them again afterwards.

Procedure
1. Stop the AC drive. PP.01 can only be changed at standstill.
2. Press **PRG**. The first menu level (function code groups) is displayed. If a user password is set (PP.00 ≠ 0), enter the password first (see chapter 9.1).
3. Select group **PP** with **UP** / **DOWN** and confirm with **ENTER**. The second menu level (function codes) is displayed.

4. Select function code **PP.01** with **UP** / **DOWN** and open the third menu level (setting value) with **ENTER**.
5. Set the value **1** with **UP** and confirm with **ENTER**. The AC drive loads the factory settings.
6. Press **PRG** to exit the menu.

Then set the parameters for the application again, e.g. command source (P0.02), frequency source (P0.03), limit frequencies, acceleration and deceleration times and the functions of the input terminals (group P4). The motor parameters (group P1) do not have to be entered again.



Note:
After restoring the factory settings, the direction of rotation (P0.09), the command source and the terminal functions are also reset to their factory settings. Before the next start, check that the machine can be operated safely with these settings, especially in systems where a reversed direction of rotation can cause damage.

5.3 Operating Status

5.3.1 Power-On Initialization

During the power-on sequence of the AC drive, the system first performs a self-initialization, during which all display indicators light up simultaneously. Once initialization is complete, the drive enters standby mode.

5.3.2 Standby Status

A variety of status parameters can be displayed in both stopped and running states. Whether a specific parameter is displayed is determined by the binary bit settings of function codes P7.03 (for operating parameters) and P7.05 (for stop parameters). For the specific bit definitions, please refer to the descriptions of function codes P7.03 and P7.05 (see pages 90 and 91).

5.3.3 Motor Parameter Auto-Tuning

Please refer to the detailed descriptions provided for function code P1.37 (see page 50).

5.3.4 Running Status

In the running state, up to 29 different status parameters are available, including operating frequency, set frequency, DC bus voltage, output voltage, and output current.
Whether these status parameters are displayed is determined by the binary bit selection in function codes P7.03 and P7.04. Pressing the shift key cyclically switches through the selected display parameters in the specified order.

5.3.5 Fault Status

The VCD100 series features a comprehensive range of fault monitoring functions. For detailed information, please refer to chapter 8. Troubleshooting and Fault Countermeasures.

6. Detailed Function Description

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6.1 Group P0: Basic Functions

P0.00	G/P type display		Default	Model dependent
	Setting range	1	G type (Constant torque load)	
		2	P type (Variable torque load, e.g., fans and pumps)	

Description:

This parameter defines the load characteristics power class.

Setting:

1 - G type:
Configuration is optimized for constant torque applications matching the drive's rated heavy-duty current specifications.

2 - P type:
Configuration optimizes the drive output for variable torque profiles typically found in fan and pump systems, maximizing energy efficiency.

P0.01	Control mode selection		Default	2
	Setting range	0	Sensorless vector control (SVC)	
		1	Closed loop vector control (CLV)	
		2	Voltage / Frequency control (V/F)	

Setting:

0 - Sensorless vector control (SVC):
This mode provides high-performance open-loop vector control. It is highly recommended for high-dynamic applications demanding superior torque at low speeds, such as machine tools, centrifuges, wire drawing machines, and injection molding machinery. In this configuration, one AC drive can control only a single motor.

1 - Closed-loop vector control (CLV):
This mode delivers maximum speed control accuracy and dynamic torque control response. It is tailored for complex systems like high-speed paper machinery, cranes, hoists, and elevators. In this configuration, one AC drive can control only a single motor. A pulse encoder must be installed on the motor side, and a matching PG card must be connected to the AC drive control slot.

2 - V/F control (V/F):
This mode applies traditional voltage/frequency ratio curves. It is ideal for basic industrial applications with lower dynamic requirements or multi-motor setups where a single AC drive operates multiple motors in parallel, such as fan blocks or pump arrays.



Note:
When selecting either vector control mode (SVC or CLV), performing a complete motor auto-tuning is mandatory. The advanced dynamic advantages and high-torque characteristics of vector regulation can only be fully utilized after the microprocessor has identified and saved the exact motor electrical parameters.

P0.02	Command source selection		Default	0
	Setting range	0	Operation panel control (LED off)	
		1	Terminal control (LED on)	
		2	Communication control (LED flashing)	

Description:

This parameter defines the active routing path for driving control commands, including START, STOP, Forward, Reverse, and JOG operations.

Setting:

0 - Operation panel control (LED off):
Control commands are exclusively issued via the physical keys (RUN and STOP/RESET) on the local keypad interface.

1 - Terminal control (LED on):
Control commands are triggered via external wiring connected to the multi-functional digital input terminals (X1 to X5).

2 - Communication control (LED flashing):
Control commands are received via serial communication interfaces from a host computer or PLC system.

P0.03	Main frequency source X selection		Default	0
	Setting range	0	Digital setting (P0.08 preset frequency, UP/DOWN modifiable, no memory at power-down)	
		1	Digital setting (P0.08 preset frequency, UP/DOWN modifiable, memory at power-down)	
		2	FIV	
		3	FIC	
		4	Keypad potentiometer	
		5	Pulse setting	
		6	Multi-step speed command	
		7	Simple PLC	
		8	PID control	
		9	Communication control	

Description:

Selects the primary input source channel for the main frequency setpoint. A total of 10 input channels are available.

Setting:

0 - Digital setting (No memory at power-down):
The initial setpoint is determined by parameter P0.08. An operator can use the keypad arrow keys (or multi-functional digital inputs configured for UP/DOWN functions) to dynamically alter the active reference. Upon power cycle, the modified frequency value is cleared and resets back to P0.08.

1 - Digital setting (Memory at power-down):
The initial reference is based on P0.08. The active value can be modified via the keypad arrows or terminal inputs. Upon power-down, the last active frequency setpoint is automatically saved to the internal EEPROM. When powered back up, the drive restores the last saved reference instead of reverting to P0.08.



Important Note:
Parameter P0.23 (Digital frequency setting retention selection upon stop) determines whether the drive retains or resets the active frequency reference during a standard stop condition. P0.23 manages stop behavior exclusively and operates independently from the power-down memory logic.

2 - FIV and 3 - FIC:
Frequency reference is dictated by the analog input terminals. The Velron VCD100 control board features two analog input channels. FIV operates as a standard 0V to 10V voltage input. FIC can be configured via on-board jumpers for either 0V to 10V voltage signals or 4mA to 20mA current signals. Five distinct relation curves are available: three linear curves (2-point mapping) and two non-linear curves (4-point mapping), configurable via parameter groups P4 and C6. Function code P4.33 maps the FIV and FIC signals to the respective curve group.

4 - Keypad potentiometer:
The frequency setpoint is set with the potentiometer (knob) on the keypad (see chapter 5.1.2).

5 - Pulse setting:
The frequency reference is supplied by an external high-speed pulse signal. The input specification requires a voltage range of 9V to 30V and a frequency range from 0 kHz to 100 kHz. High-speed pulse trains must be wired exclusively to terminal X5. The scaling between pulse frequency and setpoint percentage is defined via parameters P4.28 to P4.31 using a 2-point linear mapping, where 100.0% corresponds to the maximum frequency limit (P0.10).

6 - Multi-reference/ multi-step speed command:
Operating in this mode utilizes binary state combinations of the multi-functional digital input terminals to select up to 16 preset frequency values. The Velron VCD100 allows configuration of up to 4 digital inputs as multi-reference terminals. The corresponding setpoints are defined as percentages of the maximum frequency (P0.10) within parameter group PC. Terminal functionality must be assigned in group P4.

7 - Simple PLC:
In this configuration, the frequency reference changes automatically through a programmed sequential pattern of up to 16 stages. The hold time for each stage and the individual acceleration/deceleration times are defined in parameter group PC.

8 - PID control:
The output of the internal process PID controller is used as the operating frequency reference. This is ideal for closed-loop process loops such as constant pressure fluid regulation or automated tension control. Activating this requires configuring the process parameters in group PA.

9 - Communication control:
The main frequency reference is written by a master host controller or PLC via the serial interface. The Velron VCD100 natively supports RS-485 serial communication.

P0.04	**Auxiliary frequency source Y selection**		**Default**	**0**
	Setting range	**0**	Digital setting (P0.08 preset frequency, UP/DOWN modifiable, no memory at power-down)	
		1	Digital setting (P0.08 preset frequency, UP/DOWN modifiable, memory at power-down)	
		2	FIV	
		3	FIC	
		4	Keypad potentiometer	
		5	Pulse setting	
		6	Multi-step speed command	
		7	Simple PLC	
		8	PID control	
		9	Communication control	

Description:

Defines the input source channel for the auxiliary frequency reference. When utilized as an independent alternative frequency path (i.e., switching completely from X to Y), its configuration and features are identical to the main reference channel described under P0.03.
When the auxiliary channel is used in a superposition layout (e.g., mathematical combinations like X + Y, or switching between X and X + Y), the following operational rules apply:

1) When the auxiliary frequency source is set to a digital keypad reference, the preset frequency parameter (P0.08) is bypassed. Keypad arrow keys or digital UP/DOWN terminals adjust the auxiliary offset value directly on top of the active main frequency baseline.
2) When the auxiliary channel receives an analog input (FIV, FIC) or high-speed pulse train, a 100% input signal maps to the auxiliary frequency range window. This scaling window constraint is defined via parameters P0.05 and P0.06.
3) When the auxiliary frequency source is set to pulse frequency input, the scaling and range configuration operate identically to the analog input specifications.



Note:
The auxiliary frequency source Y and the main frequency source X cannot be assigned to the same input channel. This means that parameters P0.03 and P0.04 must not be set to the same selection value, as this will conflict with the reference logic and cause operational errors.

P0.05	**Auxiliary frequency source Y range selection**		**Default**	**0**
	Setting range	**0**	Relative to the maximum frequency	
		1	Relative to the main frequency source X	
P0.06	**Auxiliary frequency source Y range selection**		**Default**	**100%**
	Setting range	**0%–150%**		

Description:

When selecting a frequency source superposition mode (P0.07 is set to 1, 3, or 4), these two parameters are used to determine the adjustment range of the auxiliary frequency source Y. Parameter P0.05 determines the baseline reference object for the auxiliary frequency source. The baseline can be chosen relative to the maximum frequency (P0.10) or relative to the active main frequency source X.

Setting:

0 - Relative to the maximum frequency:
The input range of the auxiliary frequency source Y is scaled as a percentage relative to the fixed maximum frequency (P0.10).

1 - Relative to the main frequency source X:
The input range of the auxiliary frequency source Y is scaled dynamically relative to the current value of the main frequency source X.

P0.07	**Frequency source superposition selection**		**Default**	**00**
	Setting range	**Unit's digit**	**Frequency source selection**	
		0	Main frequency source X	
		1	X and Y operation (relationship determined by ten's digit)	
		2	Switchover between X and Y	
		3	Switchover between X and "X and Y operation"	
		4	Switchover between Y and "X and Y operation"	
		Ten's digit	**X and Y operation**	
		0	X + Y	
		1	X – Y	
		2	Maximum value of X and Y	
		3	Minimum value of X and Y	

Description:

This parameter configuration determines the combination and selection logic of the primary setting channels. By compounding the main frequency source X and the auxiliary frequency source Y, a highly flexible target frequency calculation is achieved.

Setting:

- **Unit's digit (Frequency source selection):**
  - **0:** The main frequency source X is used directly as the target frequency.
  - **1:** The mathematical operation result of X and Y is used as the target frequency. The specific calculation relationship is defined by the ten's digit.
  - **2:** Switchover between X and Y via digital input. When the multi-functional input terminal assigned to function 18 (Frequency source switchover) is inactive, main frequency X is the target. When function 18 is active, auxiliary frequency Y becomes the target.
  - **3:** Switchover between X and the operation result. When the multi-functional input terminal for function 18 is inactive, main frequency X is the target. When function 18 is active, the combined math operation result becomes the target.
  - **4:** Switchover between Y and the operation result. When the multi-functional input terminal for function 18 is inactive, auxiliary frequency Y is the target. When function 18 is active, the combined math operation result becomes the target.
- **Ten's digit (X and Y mathematical relationship):**
  - **0:** The target value is the sum of main frequency X plus auxiliary frequency Y (X + Y).
  - **1:** The target value is the difference of main frequency X minus auxiliary frequency Y (X - Y).
  - **2:** The target value uses the maximum absolute value between main frequency source X and auxiliary frequency source Y (MAX |X, Y|).
  - **3:** The target value uses the minimum absolute value between main frequency source X and auxiliary frequency source Y (MIN |X, Y|).

P0.08	**Preset frequency**		**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10) (Effective when digital setting is selected as frequency source)		

Description:

When the frequency source selection is set to "Digital setting" or "Terminal UP/DOWN", this function code defines the initial digital setting value for the inverter's output frequency.

P0.09	**Rotation direction**		**Default**	**0**
	Setting range	**0**	Same direction (Forward)	
		1	Reverse direction	

Description:

By changing this function code, the motor's rotation direction can be reversed without swapping the physical motor output wiring (U, V, W). Its effect is equivalent to swapping any two phases of the motor lines.



Note:
After parameter initialization (factory reset), this parameter will revert to its default state. Care must be taken in mechanical systems where a reversed running direction is strictly prohibited.

P0.10	Maximum frequency		Default	50.00 Hz
	Setting range	50.00 Hz–599.00 Hz		

Description:

This parameter defines the absolute maximum output frequency of the Velron VCD100. When using analog inputs, pulse inputs, or multi-step commands, a 100.0% signal reference is scaled and calibrated relative to this maximum frequency value (P0.10).

P0.11	Upper limit frequency source		Default	0
	Setting range	0	P0.12 digital setting	
		1	FIV	
		2	FIC	
		3	Reserved	
		4	PULSE setting	
		5	Communication setting	

Description:

Defines the source for the upper limit frequency. This limit can be a fixed digital setting (P0.12) or dynamically controlled via an analog or pulse input. When analog input is used, 100% of the input signal corresponds to P0.12.

Setting Application:

In winding applications utilizing torque control mode, an analog frequency limit can be used to prevent a dangerous "runaway" phenomenon if the material breaks. When the drive reaches this frequency limit, it will switch to constant maximum frequency operation.

P0.12	Upper limit frequency		Default	50.00 Hz
	Setting range	Lower limit frequency (P0.14) to maximum frequency (P0.10)		
P0.13	Upper limit frequency offset		Default	0.00 Hz
	Setting range	0.00 Hz to maximum frequency (P0.10)		

Description:

When the upper limit frequency source is set to an analog or pulse input, parameter P0.13 acts as a setpoint offset. The final frequency limit is determined by superimposing this offset frequency onto the reference value from P0.12.

P0.14	Lower limit frequency		Default	0.00 Hz
	Setting range	0.00 Hz to upper limit frequency (P0.12)		

Description:

When the reference frequency drops below the lower limit frequency set in P0.14, the drive's exact behavior (e.g., stop, run at the lower limit frequency, or run at zero speed) is determined by parameter P8.14.

P0.15	Carrier frequency		Default	Model dependent
	Setting range	0.5 kHz–16.0 kHz		

Description:

This function adjusts the carrier frequency of the PWM inverter output. Adjusting this value can minimize acoustic motor noise, avoid mechanical resonance points, and reduce ground leakage current or electrical electromagnetic interference (EMI).

Setting Dynamics:

A lower carrier frequency increases output current harmonics, motor losses, and motor temperature. A higher carrier frequency minimizes motor losses and temperature rise, but increases inverter losses, thermal stress on the drive, and EMI.

Carrier Frequency Performance Matrix:

Metric / Parameter	Low Carrier Frequency ➔ High Carrier Frequency
Motor acoustic noise	Large ➔ Small
Output current waveform	Poor ➔ Good
Motor temperature rise	High ➔ Low
Inverter temperature rise	Low ➔ High
Leakage current	Small ➔ Large
Radiated EMI emissions	Small ➔ Large

Note:
Different power classes of the Velron VCD100 have different factory settings. If you increase the carrier frequency above the default value, the inverter heatsink temperature will rise. In this case, you must derate the drive's output current to prevent overheating alarms.

P0.16	Carrier frequency adjustment with temperature		Default	0
	Setting range	**0**	No	
		1	Yes	

Description:

This function code allows the inverter to monitor its internal heatsink temperature. When a high radiator temperature is detected, the drive automatically reduces the carrier frequency to lower its thermal loss and decrease the temperature rise. Once the heatsink temperature drops back to a safe level, the carrier frequency returns to the user-defined setting value. Activating this feature significantly reduces the occurrence of inverter overheat (OH) alarms.

P0.17	**Acceleration time 1**		**Default**	**Model dependent**
	Setting range	0.00 s–65000 s		
P0.18	**Deceleration time 1**		**Default**	**Model dependent**
	Setting range	0.00 s–65000 s		

Description:

Acceleration time defines the period required for the inverter to ramp up from 0 Hz to the Acceleration/Deceleration time base frequency specified in P0.25.
Deceleration time defines the period required for the inverter to ramp down from the Acceleration/Deceleration time base frequency specified in P0.25 to 0 Hz.

P0.19	**Acceleration/Deceleration time unit**		**Default**	**1**
	Setting range	**0**	1 s	
		1	0.1 s	
		2	0.01 s	

Description:

To satisfy the requirements of various engineering applications, the Velron VCD100 provides three distinct time units for ramp configuration: 1 second, 0.1 seconds, and 0.01 seconds.



Note:
Modifying this parameter changes the position of the decimal point for all four groups of acceleration/deceleration time parameters. Consequently, the actual effective ramp times will change significantly. Special attention must be paid to this adjustment during system commissioning.

P0.21	**Frequency offset of auxiliary frequency source for X and Y operation**		**Default**	**0.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)		

Description:

This function code is only effective when a mathematical combination mode (Main/Auxiliary math operation) is selected in P0.07. Parameter P0.21 acts as an offset frequency that is superimposed directly onto the calculation result of the main and auxiliary frequency sources. This provides enhanced flexibility for complex frequency control demands.

P0.22	**Frequency command resolution**		**Default (read-only)**	**2**
	Setting range	**2**	0.01 Hz	

Description:

This parameter defines the absolute resolution for all function codes and internal calculations associated with the output frequency. It is a factory-configured hardware standard and cannot be modified by the user.

P0.23	Retentive of digital setting frequency upon power-down		Default	0
	Setting range	0	Not retentive	
		1	Retentive	

Description:

This function is exclusively effective when the frequency reference source is configured as a digital setting.

Setting:

0 - Not retentive:
Upon power-down or downtime, any frequency modifications made via the keypad arrow keys or digital input UP/DOWN terminals are cleared. The drive reverts to the initial preset frequency defined in P0.08 on the next power cycle.

1 - Retentive:
Upon power-down or downtime, the drive saves the last active frequency reference to its internal EEPROM. When restarted, the modifications remain valid and the drive resumes operation at the last saved frequency.

P0.25	Acceleration/Deceleration time base frequency		Default	0
	Setting range	0	Maximum frequency (P0.10)	
		1	Set frequency	
		2	100 Hz	

Description:

This parameter defines the reference frequency profile used to calculate the actual acceleration and deceleration ramp rates.

Setting:

0 - Maximum frequency (P0.10):
The ramp time indicates the period required to accelerate from 0 Hz to the maximum output frequency (P0.10).

1 - Set frequency:
The ramp time is relative to the active target setting frequency. If the target frequency changes frequently, the motor's actual acceleration rate will adapt dynamically.

2 - 100 Hz:
The ramp time indicates the fixed period required to accelerate from 0 Hz to exactly 100 Hz.

P0.26	Base frequency for UP/DOWN modification during running		Default	0
	Setting range	0	Running frequency	
		1	Set frequency	

Description:

This parameter is only valid when the frequency source is assigned to a digital setting. It determines the baseline reference value when an operator modifies the frequency using the keypad arrow keys or digital input UP/DOWN terminals.

Setting:

0 - Running frequency:
Keypad or terminal UP/DOWN adjustments increase or decrease the frequency based on the current actual operating frequency.

1 - Set frequency:
Keypad or terminal UP/DOWN adjustments increase or decrease the frequency based on the active target set frequency.



Note:
The distinction between these two modes becomes highly evident during deceleration phases when the drive's real-time running frequency lags behind the target set frequency. Selecting different values here will result in vastly different control behaviors.

P0. 27	**Binding command source to frequency source**		**Default**	**0000**
	Setting range	**Unit's digit**	**Binding keypad command to frequency source**	
		0	No binding	
		1	Digital setting frequency	
		2	FIV	
		3	FIC	
		4	Reserved	
		5	Pulse setting	
		6	Multi-step speed reference	
		7	Simple PLC	
		8	PID control	
		9	Communication setting	
		Ten's digit	**Binding terminal command to frequency source** (0–9, same as unit's digit)	
		Hundred's digit	**Binding communication command to frequency source** (0–9, same as unit's digit)	
		Thousand's digit	Reserved	

Description:

This parameter is used to directly couple the three running command channels with the nine available frequency reference sources, facilitating synchronous switchover. Different command channels can be bound to the same frequency source. If a command channel has a bound frequency source assigned to it, that safety binding takes precedence. When that specific command source becomes active, the general frequency source configurations defined in parameters P0.03 to P0.07 are bypassed.

6.2 Group P1: Motor Parameters

P1.00	**Motor type**		**Default**	**0**
	Setting range	**0**	Common asynchronous motor	
		1	Variable frequency asynchronous motor	
P1.01	**Rated motor power**		**Default**	**Model dependent**
	Setting range	0.1 kW–450.0 kW		
P1.02	**Rated motor voltage**		**Default**	**Model dependent**
	Setting range	1 V–2000 V		
P1.03	**Rated motor current**		**Default**	**Model dependent**
	Setting range	0.01 A–655.35 A		
P1.04	**Rated motor frequency**		**Default**	**Model dependent**
	Setting range	0.01 Hz to maximum frequency (P0.10)		
P1.05	**Rated motor rotational speed**		**Default**	**Model dependent**
	Setting range	1 rpm–65535 rpm		

Description (P1.00 to P1.05):

Set these parameters according to the motor's nameplate data, regardless of whether V/F control or vector control is adopted. To achieve optimal V/F or vector control performance, motor auto-tuning is strictly required. The accuracy of the motor auto-tuning depends entirely on the correct setting of these motor nameplate parameters.

P1.06	**Stator resistance (asynchronous motor)**	**Default**	**Model dependent**
	Setting range	0.001 Ω–65.535 Ω	
P1.07	**Rotor resistance (asynchronous motor)**	**Default**	**Model dependent**
	Setting range	0.001 Ω–65.535 Ω	
P1.08	**Leakage inductance (asynchronous motor)**	**Default**	**Model dependent**
	Setting range	0.01 mH–655.35 mH	
P1.09	**Mutual inductance (asynchronous motor)**	**Default**	**Model dependent**
	Setting range	0.1 mH–6553.5 mH	
P1.10	**No-load current (asynchronous motor)**	**Default**	**Model dependent**
	Setting range	0.01 A bis P1.03	

Description (P1.06 to P1.10):

The parameters in P1.06 to P1.10 represent the internal asynchronous motor equivalent circuit parameters. These values are ordinarily unavailable on the motor's nameplate and must be obtained by means of the inverter's auto-tuning function. Asynchronous motor stationary auto-tuning identifies only the parameters P1.06 to P1.08. Asynchronous motor dynamic auto-tuning identifies all equivalent circuit parameters (P1.06 to P1.10), as well as the encoder phase sequence and current loop PI gains.



Note:
Each time the "Rated motor power" (P1.01) or "Rated motor voltage" (P1.02) is modified, the AC drive automatically restores the values of P1.06 to P1.10 to the default settings of a standard asynchronous motor matching that power class. If it is impossible to perform auto-tuning, these parameters can be manually entered using data provided by the motor manufacturer.

Parameters P1.11 to P1.26 are reserved.

P1.27	**Encoder resolution**		**Default**	**1024**
	Setting range	1–65535		

Description:

This parameter is used to configure the pulses per revolution (PPR) of an ABZ or UVW incremental encoder. In closed-loop vector control (CLV) mode, the motor cannot run properly if this parameter is configured incorrectly.

P1.28	Encoder type		**Default**	**0**
	Setting range	**0**	ABZ incremental encoder	
		2	Resolver	

Description:

The Velron VCD100 supports a variety of encoder types. Different encoders require a matching PG extension card; please ensure the correct card and type are selected. Generally, ABZ incremental encoders or resolvers are chosen for asynchronous motors. After installing the PG card, P1.28 must be configured correctly, otherwise, the inverter will fail to operate properly.

P1.30	**Phase sequence of ABZ incremental encoder**		**Default**	**0**
	Setting range	**0**	Forward	
		1	Reverse	

Description:

This parameter is only valid for ABZ incremental encoders (when P1.28 = 0). It defines the phase sequence configuration of the A and B encoder channels. During dynamic auto-tuning, the correct AB phase sequence is detected and saved automatically.

P1.34	Number of resolver pole pairs		Default	1
	Setting range	1–65535		

Description:

If a resolver (rotary feedback system) is utilized, this parameter must be configured to match the exact number of pole pairs of the resolver system.

P1.36	PG card speed feedback wire-break detection time		Default	0.0
	Setting range	0.0: No action (disabled) 0.1 s–10.0 s		

Description:

This parameter defines the filter filter time that an encoder wire-break condition must persist before a fault is triggered. If the duration of the encoder wire-break fault detected by the AC drive exceeds the time set in P1.36, the drive immediately interrupts the output and reports a **PG** fault.

P1.37	Auto-tuning selection		Default	0
	Setting range	**0**	No operation	
		1	Static auto-tuning	
		2	Rotational auto-tuning	
		3	Complete static auto-tuning	

Description:

This function selects the optimization routine for identifying the equivalent circuit data of the motor. To utilize high-performance vector regulation, motor parameter self-learning is mandatory.

Setting:

0 - No operation:
Auto-tuning is disabled or prohibited.

1 - Static auto-tuning:
Applicable to applications where the motor cannot be easily uncoupled from the mechanical load. Before execution, the nameplate parameters (P1.01 to P1.05) must be set correctly. The drive will measure and calculate the stator resistance, rotor resistance, and leakage inductance (P1.06 to P1.08). To start, set P1.37 to 1 and press the RUN key.

2 - Rotational auto-tuning:
Delivers maximum precision. The motor must be completely decoupled from the load and in a no-load state. The drive first executes a static tuning routine, then accelerates the motor up to 80% of its rated frequency (P1.04) using the acceleration time set in P0.17. After holding the speed, the drive decelerates to a stop using P0.18 and saves all parameters (P1.06 to P1.10). To start, set P1.37 to 2 and press the RUN key.

3 - Complete static auto-tuning:
Advanced internal estimation algorithm used to identify all primary and mutual inductance parameters without motor shaft rotation.

Procedure:

1. Set the command source to keypad (**P0.02 = 0**) and enter the nameplate data **P1.01** to **P1.05**.
2. Set **P1.37** to the required value (1, 2 or 3) and confirm with **ENTER**. The display shows **Study**.
3. Press **RUN**. The auto-tuning begins, with setting 2 the motor is started.
4. After successful completion, the AC drive saves the determined values. The display returns to the monitoring display and shows the current frequency.

If the auto-tuning is aborted with fault **TE**, check the motor data and the motor cable (see chapter 8.1).

6.3 Group P2: Motor Vector Control Parameters

P2.00	**Speed loop proportional gain 1**		**Default**	**30**
	Setting range	1–100		
P2.01	**Speed loop integral time 1**		**Default**	**0.50 s**
	Setting range	0.01 s–10.00 s		
P2.02	**Switchover frequency 1**		**Default**	**5.00 Hz**
	Setting range	0.00 Hz to P2.05		
P2.03	**Speed loop proportional gain 2**		**Default**	**20**
	Setting range	1–100		
P2.04	**Speed loop integral time 2**		**Default**	**1.00 s**
	Setting range	0.01 s–10.00 s		
P2.05	**Switchover frequency 2**		**Default**	**10.00 Hz**
	Setting range	P2.02 to maximum frequency (P0.10)		

Description (P2.00 to P2.05):

The speed loop PI parameters dynamically adjust and scale based on the running frequency of the AC drive.
If the operating frequency is less than or equal to Switchover frequency 1 (P2.02), the speed loop PI parameters P2.00 and P2.01 are active.
If the operating frequency is greater than or equal to Switchover frequency 2 (P2.05), the speed loop PI parameters P2.03 and P2.04 are active.
If the operating frequency falls between Switchover frequency 1 and Switchover frequency 2, the active PI parameters are determined via a continuous linear interpolation between the two parameter sets (as visualized in the system's PI parameter diagram below).

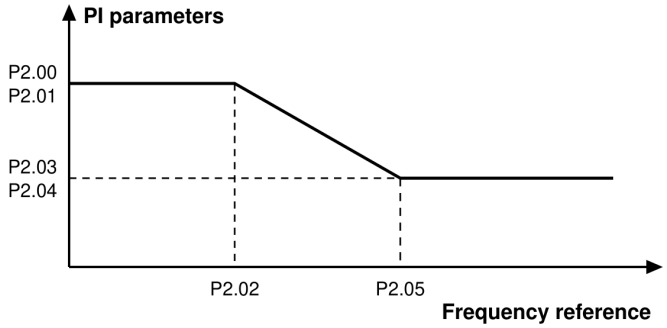


Figure 6.1 - PI parameter diagram

The dynamic speed response characteristics can be adjusted via these parameters. To achieve a faster system response, increase the proportional gain and reduce the integral time. Note that excessive adjustments can lead to system oscillation.

Adjustment Guideline:

Increase the proportional gain first to a level just below the threshold of system oscillation, then reduce the integral time to achieve a fast dynamic response with minimal overshoot. Improper settings may cause severe speed overshoot, which can trigger an overvoltage fault when the speed drops back down.

Note:
Note that an excessively large current loop PI gain may lead to severe oscillation of the entire control loop. Therefore, when current oscillation or torque fluctuation is great, manually decrease the proportional gain or integral gain settings here to stabilize the drive.

P2.06	**Vector control slip gain**	**Default**	**100%**
	Setting range	50%–200%	

Description:

For sensorless vector control (SVC), this parameter is used to optimize the steady-state speed stability and accuracy under load conditions. If the motor speed fluctuates or sags under heavy load at very low speeds, increase this parameter value. If speed instability occurs at high speeds, decrease this value.

P2.07	**Time constant of speed loop filter**	**Default**	**0.050 s**
	Setting range	0.000 s–1.000 s	

Description:

In vector control mode, the output of the speed loop regulator defines the torque current reference. This parameter applies a low-pass filter to smooth the torque references. It generally does not require modification. If the system exhibits large speed fluctuations, increase this time constant. In the event of motor resonance or mechanical oscillation, decrease this value properly. Smaller values provide quicker dynamic response but can cause higher torque ripples.

P2.08	**Vector control over-excitation gain**	**Default**	**64**
	Setting range	0–200	

Description:

During deceleration phases, over-excitation control increases the motor magnetic loss to absorb regenerative energy, effectively restraining the rise of the DC bus voltage to prevent overvoltage faults. A higher gain improves the restraining effect but increases output current and motor heating. This parameter should be set to 0 in applications with very small inertia or when a physical braking resistor is installed.

Note:
If a braking resistor is used, P9.03 (overvoltage stall gain) and P2.08 (vector control over-excitation gain) must be set to 0.

P2.09	**Torque upper limit source in speed control mode**		**Default**	**0**
	Setting range	**0**	P2.10 setting	
		1	FIV	
		2	FIC	
		3	Reserved	
		4	Pulse setting	
		5	Communication setting	
		6	MIN (FIV, FIC)	
		7	MAX (FIV, FIC)	
P2.10	**Digital setting of torque upper limit in speed control mode (motorized)**		**Default**	**150.0%**
	Setting range	0.0%–200.0%		

Description (P2.09 to P2.10):

In speed control mode, the maximum allowable output torque of the AC drive is restricted by the source chosen in P2.09. If an analog input, pulse train, or communication channel is selected, a 100.0% reference signal corresponds to the scaling percentage defined in P2.10. A value of 100.0% in P2.10 represents the nominal rated torque of the AC drive.

P2.13	**Flux adjustment proportional gain**		**Default**	**2000**
	Setting range	0–60000		
P2.14	**Flux adjustment integral gain**		**Default**	**1300**
	Setting range	0–60000		
P2.15	**Torque adjustment proportional gain**		**Default**	**2000**
	Setting range	0–60000		
P2.16	**Torque adjustment integral gain**		**Default**	**1300**
	Setting range	0–60000		

Description (P2.13 to P2.16):

These parameters define the internal current loop PI controller values for vector control. They are automatically measured and updated during a complete dynamic motor auto-tuning routine (P1.37=2) and typically do not require manual adjustment. Note that the integral parameter utilizes an absolute integral gain scaling factor rather than an integral time constant. If severe current oscillation or torque ripples occur due to improper identification, manually decrease these proportional and integral gains.

6.4 Group P3: V/F Control Parameters

This group of function codes applies exclusively to V/F control mode and has no effect when vector control (SVC or CLV) is active.

V/F control is highly applicable to low-load industrial profiles (such as fan or pump systems) or installations where one AC drive operates multiple motors in parallel, or where a significant difference exists between the rated power class of the AC drive and the connected motor.

P3.00	**V/F curve setting**		**Default**	**0**
	Setting range	**0**	Linear V/F	
		1	Multi-point V/F	
		2	Square V/F	
		3	1.2-power V/F	
		4	1.4-power V/F	
		5	Reserved	
		6	1.6-power V/F	
		7	Reserved	
		8	1.8-power V/F	
		9	Reserved	
		10	V/F complete separation	
		11	V/F half separation	

Description:

This parameter defines the voltage/frequency ratio configuration used to adapt the drive's output characteristics to the load profile.
and deceleration ramp rates.

Setting:

0 - Linear V/F:
Applicable to common constant torque loads.

1 - Multi-point V/F:
Applicable to special loads such as dehydrators and centrifuges. Any custom V/F curve can be defined by configuring parameters P3.03 to P3.08.

2 - Square V/F:
Applicable to centrifugal loads such as fan blocks and pump arrays.

3 - 8 Variable power V/F:
Defines transitional curve profiles falling between a linear and a square V/F characteristic.

10 - V/F complete separation:
The output frequency and output voltage of the AC drive operate completely independently. The output frequency is dictated by the selected frequency source, while the output voltage is decoupled and driven by the "Voltage source for V/F separation" (P3.13). This setup is ideal for induction heating, inverter power supplies, and torque motor control.

11 - V/F half separation:
In this configuration, voltage (V) and frequency (F) remain proportional, and the specific proportional relationship can be adjusted via P3.13. The absolute voltage level scales relative to the rated motor voltage and frequency defined in Group P1. Assuming the voltage source input is X (0% to 100%), the proportional relationship is calculated as:

V/F = 2 × X × (Rated motor voltage) / (Rated motor frequency).

P3.01	**Torque boost**	**Default**	**Model dependent**
	Setting range	0.0%: Automatic torque boost 0.1%–30.0%: Manual torque boost	
P3.02	**Cut-off frequency of torque boost**	**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	

Description (P3.01 and P3.02):

To compensate for the low-frequency torque degradation inherent to V/F control, the drive can boost the output voltage at lower speeds. If the manual torque boost (P3.01) is set to an excessively large value, the motor may overheat and the AC drive can trigger overcurrent protection. Increase P3.01 if the mechanical load is high and the startup torque is insufficient. Decrease P3.01 if the load is minimal.

If P3.1 is set to 0.0% the AC drive calculates the required voltage boost dynamically based on identified motor parameters, including stator resistance

P3.02 specifies the upper frequency threshold under which torque boost remains active. Once the operating frequency exceeds the value defined in P3.02, the torque boost function is disabled (as shown in the Manual torque boost diagram).

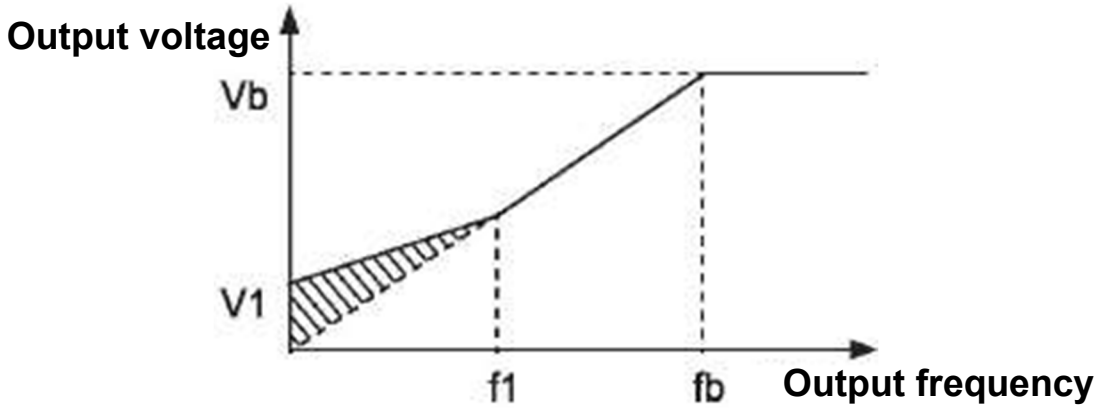


Figure 6.2 - Manual torque boost diagram

Legend:

V1: Voltage of manual torque boost
Vb: Rated motor voltage
f1: Cut-off frequency of manual torque boost
fb: Rated motor frequency

P3.03	**Multi-point V/F frequency 1**		**Default**	**0.00 Hz**
	Setting range	0.00 Hz to P3.05		
P3.04	**Multi-point V/F voltage 1**		**Default**	**0.0%**
	Setting range	0.0%–100.0%		
P3.05	**Multi-point V/F frequency 2**		**Default**	**0.00 Hz**
	Setting range	P3.03 to P3.07		
P3.06	**Multi-point V/F voltage 2**		**Default**	**0.0%**
	Setting range	0.0%–100.0%		
P3.07	**Multi-point V/F frequency 3**		**Default**	**0.00 Hz**
	Setting range	P3.05 to rated motor frequency (P1.04)		
P3.08	**Multi-point V/F voltage 3**		**Default**	**0.0%**
	Setting range	0.0%–100.0%		

Description (P3.03 to P3.08):

These six parameters define the custom multi-point V/F curve based on the unique load characteristics of the application. The operational coordinates must strictly satisfy the following logical constraints: **V1 ≤ V2 ≤ V3** and **F1 ≤ F2 ≤ F3** (as shown in the Multi-point V/F curve setting diagram).

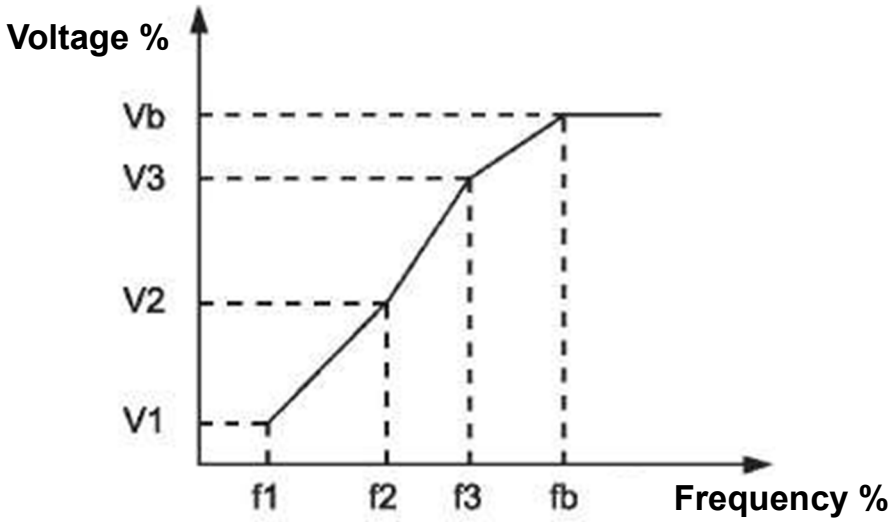


Figure 6.3 - Multi-point V/F curve setting diagram

Legend:

V1-V3: Multi-point V/F stage 1–3 voltage percentage
f1-f3: Multi-point V/F stage 1–3 frequency percentage
Vb: Rated motor voltage
fb: Rated motor frequency

Warning:
Configuring an excessively high voltage level at a low-frequency coordinate can lead to severe motor overheating, insulation burn-out, or trigger an overcurrent stall and overcurrent protection fault within the AC drive.

P3.09	V/F slip compensation gain		Default	0.0%
	Setting range	0.0%–200.0%		

Description:

This parameter applies exclusively to common asynchronous motors. It dynamically compensates for the rotational speed slip that occurs when the motor load increases, stabilizing the mechanical shaft speed across variable load transitions. If set to 100.0%, the drive applies full slip compensation equal to the motor's rated slip value when bearing nominal load. The nominal slip baseline is automatically calculated by the microprocessor using the rated frequency (P1.04) and rated speed (P1.05) from Group P1. If the actual shaft speed deviates slightly from the target setpoint under rated load, adjust this parameter value incrementally.

P3.10	V/F over-excitation gain		Default	64
	Setting range	0–200		

Description:

During drive deceleration phases, over-excitation control restrains the regenerative rise of the DC bus voltage by increasing internal magnetic losses, preventing overvoltage faults. A higher value improves the braking effect but leads to an increase in output current and thermal motor stress. This parameter must be set to 0 in applications with very small inertia or when a physical braking resistor is installed.

P3.11	V/F oscillation suppression gain		Default	Model dependent
	Setting range	0–100		

Description:

This parameter suppresses current and speed instability often encountered in V/F systems. To avoid negative side-effects on control smoothness, the gain should be kept as low as possible. Set this parameter to 0 if the motor operates completely smoothly. Increase the value incrementally only if obvious motor oscillation is detected. The larger the value, the stronger the damping effect will be. For effective suppression, the rated motor current (P1.03) and no-load current (P1.10) must be identified correctly.

P3.13	**Voltage source for V/F separation**		**Default**	**0**
	Setting range	**0**	Digital setting (P3.14)	
		1	FIV	
		2	FIC	
		3	Reserved	
		4	PULSE setting	
		5	Multi-step speed reference	
		6	Simple PLC	
		7	PID control	
		8	Communication setting	
P3.14	**Voltage digital setting for V/F separation**		**Default**	**0 V**
	Setting range	0.0%–100.0%		

Description (P3.13 to P3.14):

V/F separation is generally applicable to specialized industrial applications such as induction heating, inverter power supplies, and torque motor control.

When V/F separation is active, the output voltage can be set via the digital parameter P3.14 or dynamically through analog terminals, multi-reference steps, simple PLC patterns, PID loops, or communication commands.

For all non-digital settings, 100% of the input value scales to the rated motor voltage. If a negative percentage is set, its absolute value is used as the active reference.

Setting:

0 - Digital setting (P3.14):
The output voltage is set directly and statically by P3.14.

1 - FIV / 2 - FIC:
The output voltage is driven dynamically via the analog input terminals

4 - PULSE setting:
The output voltage is driven via high-speed pulses at the terminal (Voltage range: 9–30 V, frequency range: 0–100 kHz).

5 - Multi-step speed reference:
Multi-reference mode utilizes parameter settings in groups P4 and PC to map external states to specific voltage targets.

6 - Simple PLC:
Simple PLC mode utilizes parameters in group PC to sequentially cycle the output voltage.

7 - PID control:
The output voltage is driven dynamically by the process PID closed-loop controller output (see group PA).

8 - Communication setting

The output voltage is set directly by a host computer or master PLC via the communication interface.

Note:
For settings 1 to 8, a range of 0% to 100% maps directly from 0 V to the rated motor voltage.

P3.15	**Voltage acceleration time of V/F separation**	**Default**	**0.0 s**
	Setting range	0.0 s–1000.0 s (Time for the voltage to ramp from 0 V to rated motor voltage)	
P3.16	**Voltage deceleration time of V/F separation**	**Default**	**0.0 s**
	Setting range	0.0 s–1000.0 s (Time for the voltage to ramp from rated motor voltage to 0 V)	

Description:

P3.15 defines the time required for the output voltage to rise from 0 V to the rated motor voltage.
P3.16 defines the time required for the output voltage to fall from the rated motor voltage back to 0 V (as visualized in the V/F separation diagram).

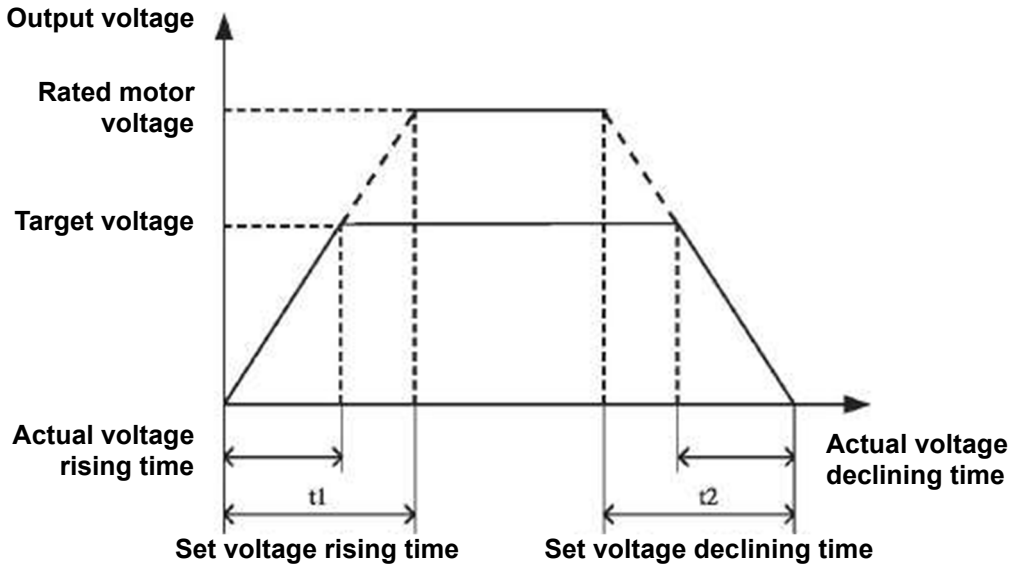


Figure 6.4 - V/F separation diagram

P3.17	**Stop mode of V/F separation**		**Default**	**0**
	Setting range	**0**	Frequency and voltage decrease independently to 0	
		1	Frequency starts to decrease only after voltage reaches 0	

Setting:

0: Upon a stop command, the output voltage ramps down to 0 V within the voltage decline time (P3.16) while the output frequency simultaneously ramps down to 0 Hz within the standard deceleration time (P0.18).

1: Upon a stop command, the output voltage first ramps down to 0 V within the voltage decline time (P3.16). Only after the voltage reaches exactly 0 V does the output frequency begin to ramp down to 0 Hz within the deceleration time (P0.18).

P3.18	**Action current of overcurrent stall**		**Default**	**150%**
	Setting range	50%–200%		
P3.19	**Overcurrent stall enable**		**Default**	**1**
	Setting range	**0**	Disabled	
		1	Enabled	

Description (P3.18 and P3.19):

During acceleration, constant speed, or deceleration phases, if the output current exceeds the stall threshold, the overcurrent stall protection engages. The drive automatically reduces its output frequency to restrain the current. Once the current drops below the threshold, the drive re-accelerates back to the target frequency. If the acceleration rate is insufficient under high load, adjust the stall current threshold (P3.18) properly.

P3.20	**Overcurrent stall suppression gain**		**Default**	**20**
	Setting range	0–100		
P3.21	**Action current compensation coefficient of multiple overcurrent stall**		**Default**	**50%**
	Setting range	50%–200%		

Description (P3.20 and P3.21):

In the high-frequency zone (above rated motor frequency), the motor driving current capability is naturally reduced. If the same stall threshold is kept, the motor speed might drop excessively. Parameter P3.21 applies a multi-frequency compensation to lower the stall current threshold automatically at high speeds, which is highly effective for centrifuge applications running above nominal frequency.

The dynamic stall threshold calculation exceeding rated frequency is:

Threshold = (fs / fn) × k × LimitCur.

Where fs is the operating frequency, fn is the rated motor frequency, k is the coefficient from P3.21, and LimitCur is the baseline threshold from P3.18.

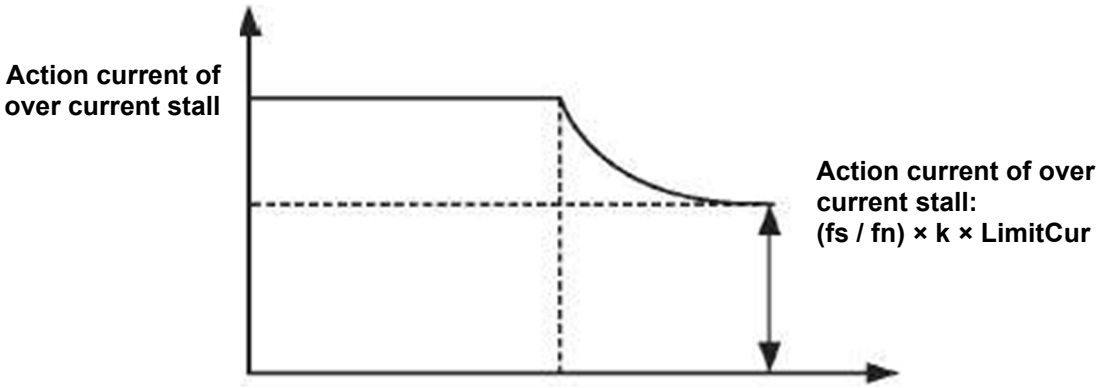


Figure 6.5 - Stall current threshold diagram

P3.22	**Action voltage of overvoltage stall**		**Default**	**760.0 V**
	Setting range	200.0 V–2000.0 V		
P3.23	**Overvoltage stall enable**		**Default**	**1**
	Setting range	**0**	Disabled	
		1	Enabled	
P3.24	**Overvoltage stall suppression gain**		**Default**	**30**
	Setting range	0–100		
P3.25	**Overvoltage stall suppression voltage gain**		**Default**	**30**
	Setting range	0–100		
P3.26	**Maximum rising frequency limit of overvoltage stall**		**Default**	**5 Hz**
	Setting range	0 Hz–50 Hz		

Description (P3.22 to P3.26):

Increasing the value of P3.24 improves the dynamic control response of the DC bus voltage during regeneration, but may introduce frequency oscillations. Decrease P3.24 if the output frequency oscillates significantly. Increasing P3.25 effectively minimizes the voltage overshoot on the bus. The maximum frequency step allowed to counteract an overvoltage condition is capped by P3.26.

Note:
When a physical braking resistor or external braking unit is installed, parameter P3.10 (Over-excitation gain) must be set to 0 to prevent excessive running currents. Furthermore, P3.23 (Overvoltage stall enable) should be set to 0 (Disabled), otherwise, the deceleration ramp times may become undesirably long due to automatic stall prevention.

6.5 Group P4: Input Terminals

The Velron VCD100 series inverter features 3 multi-function digital inputs as standard (where X5 can be configured as a high-speed pulse input terminal).

P4.00	**X1 function selection**		**Default**	**1 (Forward RUN)**
	Setting range	0-50		
P4.01	**X2 function selection**		**Default**	**2 (Reverse operation)**
	Setting range	0-50		
P4.04	**X5 function selection**		**Default**	**13 (Multi-reference 2)**
	Setting range	0-50		

Description:

These parameters are used to assign specific digital control tasks to the multi-function input terminals.

Multi-Function Digital Input Assignment Matrix:

Value	Function	Functional Description
0	No function	Assigned to unutilized terminals to prevent accidental triggering or malfunction.
1	Forward run (FWD)	Terminal controls the forward running operation of the AC drive.
2	Reverse run (REV)	Terminal controls the reverse running operation of the AC drive.
3	Three-line control	Terminal defines the three-line macro control mode. For routing details, see parameter P4.11.
4	Forward JOG (FJOG)	Triggers forward tipping operation. JOG frequency, acceleration, and deceleration times are configured via parameters P8.00, P8.01, and P8.02.
5	Reverse JOG (RJOG)	Triggers reverse tipping operation. JOG frequency, acceleration, and deceleration times are configured via parameters P8.00, P8.01, and P8.02.
6	Terminal UP	Acts as a progressive frequency increment command when frequency source is set to terminal control or digital setting adjustment.
7	Terminal DOWN	Acts as a progressive frequency decrement command when frequency source is set to terminal control or digital setting adjustment.
8	Coast to stop	AC drive blocks its output instantly. The motor coasts freely to a halt without drive decelerating control (identical to P6.10=1).
9	Fault reset (RESET)	Executes a remote fault acknowledgment, equivalent to the local STOP/RESET key function on the panel.

Value	Function	Functional Description
10	RUN pause	AC drive decelerates to stop, but all current program parameters (PLC stage, swing frequencies, PID states) are retained in memory. Resumes original state when disabled.
11	External fault NO input	Connects a normally open external safety contact. When closed (ON), the drive trips and reports an **EF** fault code (see P9.47).
12	Multi-reference terminal 1	Digital input bit 1 used for multi-step binary configuration. Combinations of terminals 1–4 enable 16 preset target references (see group PC).
13	Multi-reference terminal 2	Digital input bit 2 used for multi-step binary configuration. Combinations of terminals 1–4 enable 16 preset target references (see group PC).
14	Multi-reference terminal 3	Digital input bit 3 used for multi-step binary configuration. Combinations of terminals 1–4 enable 16 preset target references (see group PC).
15	Multi-reference terminal 4	Digital input bit 4 used for multi-step binary configuration. Combinations of terminals 1–4 enable 16 preset target references (see group PC).
16	Accel/Decel time selection 1	Ramp selection bit 1. Binary combinations of selections 1 & 2 toggle between four distinct groups of acceleration/deceleration times.
17	Accel/Decel time selection 2	Ramp selection bit 2. Binary combinations of selections 1 & 2 toggle between four distinct groups of acceleration/deceleration times.
18	Frequency source switchover	Terminal triggers a rapid toggle between the main frequency source channels as specified by the combination mode in P0.07.
19	UP/DOWN setting clear	Clears any temporary frequency offset values introduced via terminal UP/DOWN or keypad arrow inputs, returning the target directly to P0.08.
20	Command source switchover	Toggles control command priority. Switches between terminal control (P0.02=1) or communication control (P0.02=2) and the local operation panel.
21	Accel/Decel prohibited	Forces the AC drive to freeze and lock the current output frequency, overriding external reference changes (except STOP commands).
22	PID pause	Temporarily deactivates active PID loop processing. The drive freezes and maintains its current output frequency baseline.
23	PLC status reset	Restores the original initial baseline status of the Simple PLC program sequence when restarted after a pause condition.
24	Swing pause	Bypasses active traverse/swing frequency modulations and forces the drive to maintain the central base output frequency.
25	Counter input	Input terminal assigned to count external hardware pulse trains.

Value	Function	Functional Description
26	Counter reset	Input terminal resets the internal pulse counter status back to zero.
27	Length counter input	Input terminal assigned to read external length measurement pulses.
28	Length reset	Input terminal resets the internal processed length counter back to zero.
29	Torque control prohibited	Deactivates active torque control mode and forces the AC drive back into standard speed control mode.
30	Pulse input	Configures terminal X5 to accept high-speed pulse train settings (valid only on terminal X5).
31	Reserved	Internal system reservation.
32	Immediate DC braking	When activated (ON), the drive immediately ceases standard modulation and switches to static DC injection braking.
33	External fault NC input	Connects a normally closed external safety chain. When opened (OFF), the drive trips immediately and reports an **EF** fault code.
34	Frequency modification forbidden	When active, the drive ignores any digital or terminal command attempts to modify the active frequency reference.
35	Reverse PID action direction	Inverts the process PID controller feedback error polarity relative to the baseline configuration in PA.03.
36	External STOP terminal 1	Provides a remote terminal stop path matching the identical functionality of the local STOP/RESET key in keypad mode.
37	Command source switchover 2	Toggles control command priority specifically between terminal control and communication control channels.
38	PID integral pause	Pauses the integral component (I) of the process PID loop. Proportional (P) and differential (D) corrections remain active.
39	Switchover X to preset frequency	Replaces the active main frequency source X channel completely with the static digital frequency defined in P0.08.
40	Switchover Y to preset frequency	Replaces the active auxiliary frequency source Y channel completely with the static digital frequency defined in P0.08.
43	PID parameter switchover	Toggles active PID parameter sets when PA.18=1. Uses PA.05–PA.07 when inactive (OFF), and switches to PA.15–PA.17 when active (ON).
44	Reserved	Internal system reservation.
45	Reserved	Internal system reservation.

Value	Function	Functional Description
46	Speed/Torque control switchover	Toggles the active control macro between speed regulation and torque regulation mode. When inactive (OFF), the setting in C0.00 applies.
47	Emergency stop	Drives a rapid deceleration stop profile within the shortest technical window while maintaining the current current upper limit.
48	External STOP terminal 2	Forces a controlled deceleration stop across all control modes (panel, terminal, bus) using the deceleration time group 4.
49	Deceleration DC braking	Decelerates the drive down to the stop DC braking initial frequency (P6.11) before executing automated static DC injection braking.
50	Clear current running time	Resets the active running timer value. This function must be supported by configurations in parameters P8.42 and P8.53.

Additional Table 1: Multi-Reference Terminal Combinations

The four multi-reference terminals provide 16 distinct state combinations, corresponding to 16 preset reference values, as listed in the table below:

K4	K3	K2	K1	Reference Setting	Corresponding Parameter
OFF	OFF	OFF	OFF	Multi-reference 0 (Setpoint stage 0)	**PC.00**
OFF	OFF	OFF	**ON**	Multi-reference 1 (Setpoint stage 1)	**PC.01**
OFF	OFF	**ON**	OFF	Multi-reference 2 (Setpoint stage 2)	**PC.02**
OFF	OFF	**ON**	**ON**	Multi-reference 3 (Setpoint stage 3)	**PC.03**
OFF	**ON**	OFF	OFF	Multi-reference 4 (Setpoint stage 4)	**PC.04**
OFF	**ON**	OFF	**ON**	Multi-reference 5 (Setpoint stage 5)	**PC.05**
OFF	**ON**	**ON**	OFF	Multi-reference 6 (Setpoint stage 6)	**PC.06**
OFF	**ON**	**ON**	**ON**	Multi-reference 7 (Setpoint stage 7)	**PC.07**
ON	OFF	OFF	OFF	Multi-reference 8 (Setpoint stage 8)	**PC.08**
ON	OFF	OFF	**ON**	Multi-reference 9 (Setpoint stage 9)	**PC.09**
ON	OFF	**ON**	OFF	Multi-reference 10 (Setpoint stage 10)	**PC.10**
ON	OFF	**ON**	**ON**	Multi-reference 11 (Setpoint stage 11)	**PC.11**
ON	**ON**	OFF	OFF	Multi-reference 12 (Setpoint stage 12)	**PC.12**
ON	**ON**	OFF	**ON**	Multi-reference 13 (Setpoint stage 13)	**PC.13**
ON	**ON**	**ON**	OFF	Multi-reference 14 (Setpoint stage 14)	**PC.14**
ON	**ON**	**ON**	**ON**	Multi-reference 15 (Setpoint stage 15)	**PC.15**

Description:

If the active frequency reference source is set to multi-reference mode, a value of 100.0% within parameters PC.00 to PC.15 scales directly to the maximum frequency limit defined in P0.10. Besides standard multi-step speed profiles, the multi-reference logic can also be utilized as a dynamic process PID setpoint source or a decoupled voltage source for V/F separation, satisfying flexible application switchovers.

Additional Table 2: Acceleration/Deceleration Time Group Selection

The combinations of the two digital input terminals configured for acceleration/deceleration time selection determine which of the four ramp time groups is active:

Terminal 2	Terminal 1	Accel-/Deceleration Time Selection	Corresponding Parameters
OFF	OFF	**Acceleration/Deceleration time 1**	**P0.17, P0.18**
OFF	**ON**	**Acceleration/Deceleration time 2**	**P8.03, P8.04**
ON	OFF	**Acceleration/Deceleration time 3**	**P8.05, P8.06**
ON	**ON**	**Acceleration/Deceleration time 4**	**P8.07, P8.08**

P4.10	**Filter time**		**Default**	**0.010 s**
	Setting range	0.000 s–1.000 s		

Description:

This parameter defines the software-based digital filtering time constant for all digital input terminals. If the control lines are susceptible to electromagnetic noise or contact bounce causing unintended operations, increase this filter value to enhance noise immunity.



Note:
Increasing the filter time introduces a slight transmission delay and reduces the dynamic terminal response.

P4.11	**Terminal command mode**		**Default**	**0**
	Setting range	**0**	Two-line mode 1	
		1	Two-line mode 2	
		2	Three-line mode 1	
		3	Three-line mode 2	

Description:

This parameter defines how external digital terminals macro-control the run, stop, and rotation mechanics of the inverter.

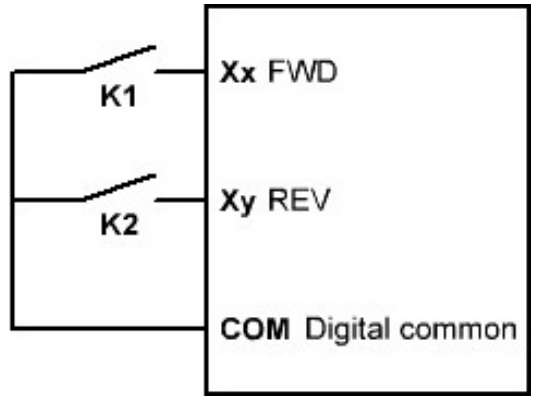
Setting:

The detailed configuration matrix for each terminal command mode, along with the corresponding electrical wiring diagrams utilizing edge-triggered and level-sensitive symbols, is provided in the tabular overview on the following page.

0 - Two-line mode 1:
The most common operating configuration. The running command and direction profile are statically determined by inputs at terminals **Xx** and **Xy**.
The parameters are set as below:

Terminal	Set Value	Functional Description
Xx	**1**	Forward RUN (FWD)
Xy	**2**	Reverse RUN (REV)

Terminals **Xx** and **Xy** are assigned via the multi-functional input terminals X1 to X5 and operate as level-sensitive inputs.

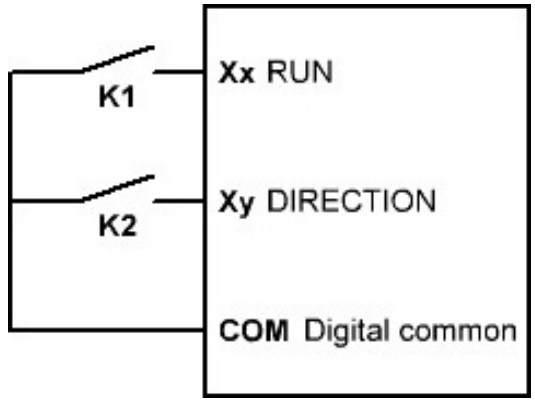


K1	K2	Run Command
0	**0**	**STOP**
1	**0**	**FWD**
0	**1**	**REV**
1	**1**	**STOP**

Figure 6.6 – Two-line mode 1

1 - Two-line mode 2:
Terminal **Xx** operates purely as the dedicated run/stop switch, while terminal **Xy** dictates the specific directional status.

Terminals **Xx** and **Xy** are assigned via the multi-functional input terminals X1 to X5 and operate as level-sensitive inputs.

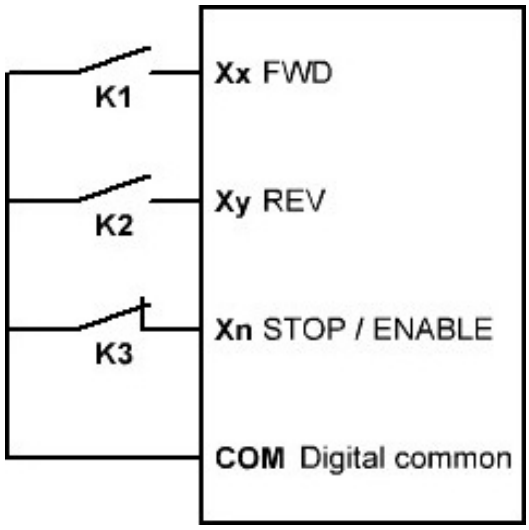


K1	K2	Run Command
0	**0**	**STOP**
1	**0**	**FWD**
1	**1**	**REV**
0	**1**	**STOP**

Figure 6.7 – Two-line mode 2

2 - Three -line mode 1:
Terminal **Xn** acts as a normally closed (NC) Stop enable input path. Commands for forward **Xx** and reverse **Xy** operation are latched.

Terminals **Xx, Xy** and **Xn** are assigned via the multi-functional input terminals X1 to X5. **Xn** operate as level-sensitive input, **Xx** and **Xy** operate as pulse-sensitive inputs.

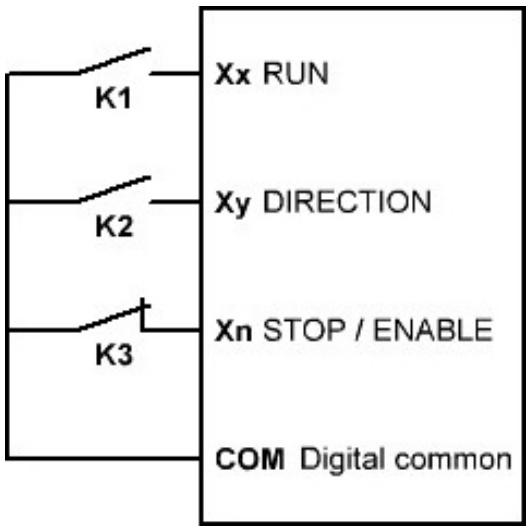


K1	K2	K3	Run Command
0	0	0	STOP
1 ⇧	0	1	FWD
0	1 ⇧	1	REV
0	0	1	STOP
1 ⇧	1 ⇧	0	STOP
1 ⇧	1 ⇧	1	STOP

Figure 6.8 – Three-line mode 1

3 - Three -line mode 2:
Terminal **Xn** acts as a normally closed (NC) Stop enable input. The start command is latched via terminal **Xx**, while direction is statically assigned by terminal **Xy**.

Terminals **Xx, Xy** and **Xn** are assigned via the multi-functional input terminals X1 to X5. **Xn** and **Xy** operate as level-sensitive input, **Xx** operate as pulse-sensitive inputs.



K1	K2	K3	Run Command
0	0	0	STOP
1 ⇧	0	1	FWD
1 ⇧	1	1	REV

Figure 6.9 – Three-line mode 2

P4.12	**Terminal UP/DOWN rate**	**Default**	**1.00 Hz/s**
	Setting range	0.001 Hz/s–65.535 Hz/s	

Description:

Defines the dynamic scaling factor (frequency variation step per second) when adjusting the active target reference via configured terminal UP/DOWN inputs.

P4.13	**FI curve 1 minimum input**	**Default**	**0.00 V**
	Setting range	0.00 V to P4.15	
P4.14	**Corresponding setting of FI curve 1 minimum input**	**Default**	**0.0%**
	Setting range	-100.0% to +100.0%	
P4.15	**FI curve 1 maximum input**	**Default**	**10.00 V**
	Setting range	P4.13 to +10.00 V	
P4.16	**Corresponding setting of FI curve 1 maximum input**	**Default**	**100.0%**
	Setting range	-100.0% to +100.0%	
P4.17	**FI curve 1 filter time**	**Default**	**0.10 s**
	Setting range	0.00 s–10.00 s	

Description (P4.13 to P4.17):

These parameters define the linear scaling mapping curve between the physical raw analog input hardware signals and the processed internal command percentages. When the input voltage exceeds the maximum constraint (P4.15), the upper value calculation is clamped by P4.16. When the input drops below the minimum constraint (P4.13), the logic falls back to P4.14 or clamps to 0.0% based on parameter P4.34.

Signal Conversion Note:
When current-based signals (4–20 mA) are routed into a hardware interface configured for voltage matching, a 1 mA analog current input translates internally to an operational equivalent of exactly 0.50 V.
The analog input filter time constant establishes a software low-pass filter to smooth the incoming raw signals. Increase this filtering constant if the environment induces noise fluctuations on the analog lines to stabilize references, keeping in mind that high values will slow down the signal response rate.

Two typical setting examples are shown in the following figures on the following page.

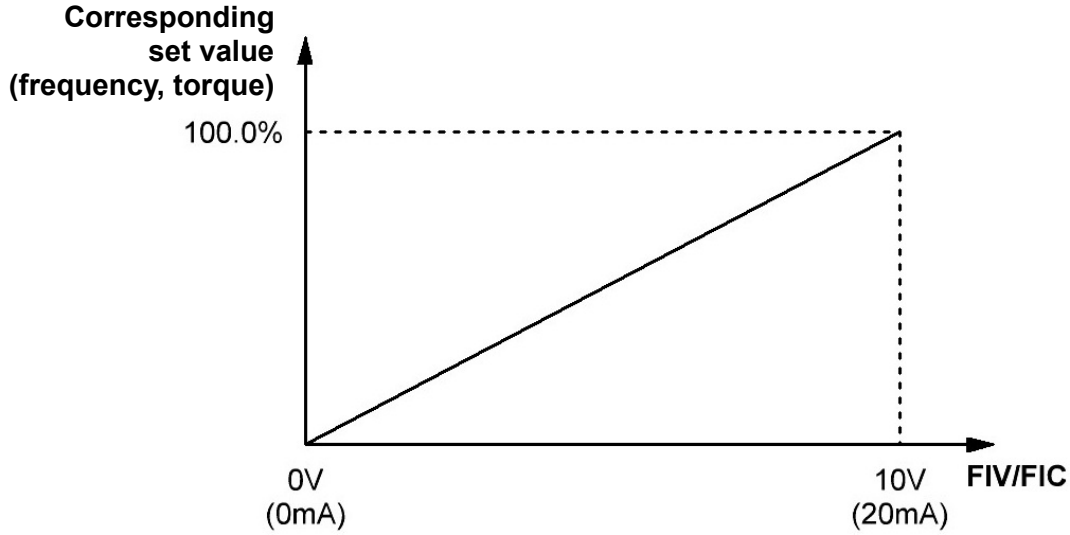


Figure 6.10 - Analog Input Scaling Characteristics 0% - 100%

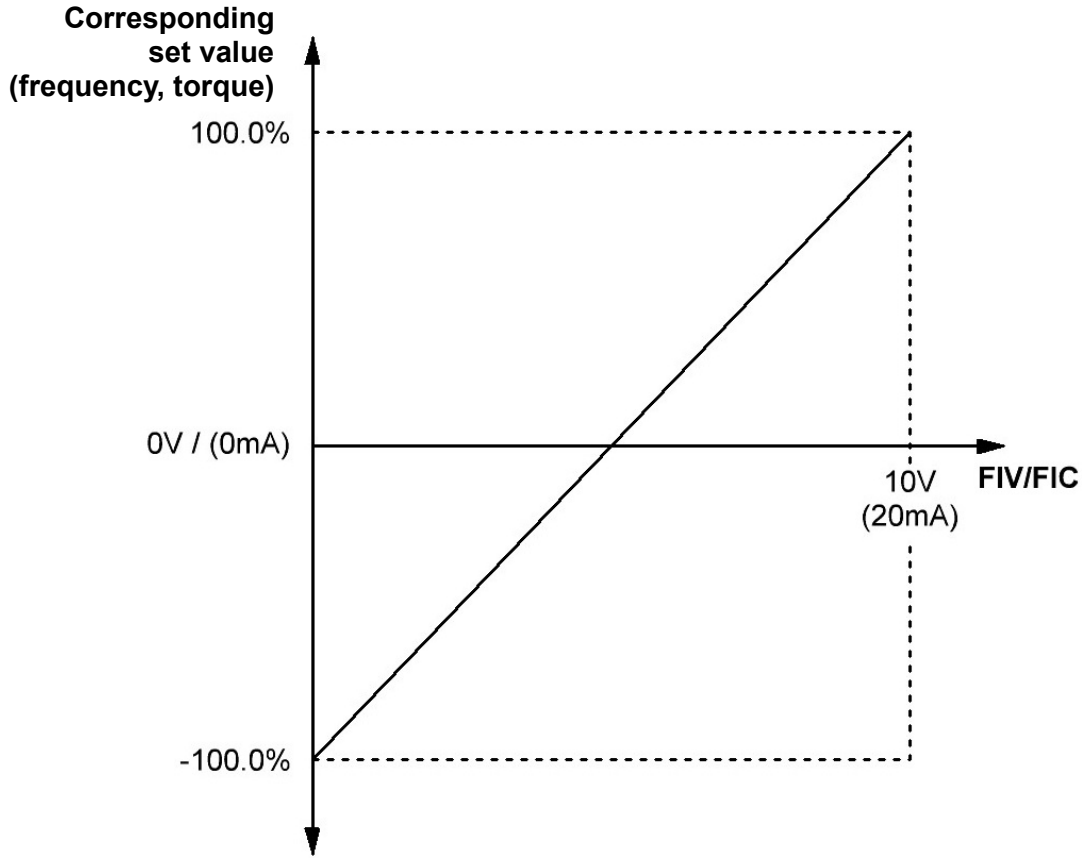


Figure 6.11 - Analog Input Scaling Characteristics -100% - 100%

P4.18	**FI curve 2 minimum input**	**Default**	**0.00 V**
	Setting range	0.00 V to P4.20	
P4.19	**Corresponding setting of FI curve 2 minimum input**	**Default**	**0.0%**
	Setting range	-100.0% to +100.0%	
P4.20	**FI curve 2 maximum input**	**Default**	**10.00 V**
	Setting range	P4.18 to +10.00 V	
P4.21	**Corresponding setting of FI curve 2 maximum input**	**Default**	**100.0%**
	Setting range	-100.0% to +100.0%	
P4.22	**FI curve 2 filter time**	**Default**	**0.10 s**
	Setting range	0.00 s–10.00 s	

Description (P4.18 to P4.22):

The configuration method and functions of FI curve 2 are identical to the functionalities described under FI curve 1 (P4.13 to P4.17).

P4.23	**FI curve 3 minimum input**	**Default**	**-10.00 V**
	Setting range	-10.00 V to P4.25	
P4.24	**Corresponding setting of FI curve 3 minimum input**	**Default**	**0.0%**
	Setting range	-100.0% to +100.0%	
P4.25	**FI curve 3 maximum input**	**Default**	**10.00 V**
	Setting range	P4.23 to +10.00 V	
P4.26	**Corresponding setting of FI curve 3 maximum input**	**Default**	**100.0%**
	Setting range	-100.0% to +100.0%	
P4.27	**FI curve 3 filter time**	**Default**	**0.10 s**
	Setting range	0.00 s–10.00 s	

Description (P4.23 to P4.27):

The configuration method and functions of FI curve 3 are identical to the functionalities described under FI curve 1 (P4.13 to P4.17), but explicitly allow negative voltage scaling down to -10.00 V for bi-directional reference profiles.

P4.28	**PULSE minimum input**		**Default**	**0.00 kHz**
	Setting range	0.00 kHz to P4.30		
P4.29	**Corresponding setting of pulse minimum input**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
P4.30	**PULSE maximum input**		**Default**	**50.00 kHz**
	Setting range	P4.28 to 100.00 kHz		
P4.31	**Corresponding setting of pulse maximum input**		**Default**	**100.0%**
	Setting range	-100.0% to +100.0%		
P4.32	**PULSE filter time**		**Default**	**0.10 s**
	Setting range	0.00 s–10.00 s		

Description (P4.28 to P4.32):

These parameters define the scaling mapping curve between an external high-speed pulse frequency train input and the corresponding internal processed reference percentage. Pulse commands are accepted exclusively via the multi-functional digital terminal X5. The calibration and filtering configurations operate identically to the methods described under FI curve 1.

P4.33	**FI curve selection**		**Default**	**321**
	Setting range	**Unit's digit**	**FIV curve selection**	
		1	Curve 1 (2 points, see P4.13–P4.16)	
		2	Curve 2 (2 points, see P4.18–P4.21)	
		3	Curve 3 (2 points, see P4.23–P4.26)	
		4	Curve 4 (4 points, see C6.00–C6.07)	
		5	Curve 5 (4 points, see C6.08–C6.15)	
		Ten's digit	**FIC curve selection** (1–5, same as FIV)	
		Hundred's digit	Reserved	

Description:

This parameter is used to assign individual calibration reference curves to the analog input channels. Any of the five specific relationship profiles can be linked independently to the two physical hardware inputs. Curves 1, 2, and 3 represent basic standard 2-point linear lines configured within group P4, while curves 4 and 5 act as highly flexible non-linear 4-point paths defined within group C6.

P4.34	**Setting selection for FI less than minimum input**		**Default**	**000**
	Setting range	**Unit's digit**	**Setting for FIV less than minimum input**	
		0	Corresponds to the minimum input settings	
		1	0.0%	
		Ten's digit	**Setting selection for FIC** (0–1, same as FIV)	

Description:

Determines the internal behavior and calculation method when the physical raw input voltage falls below the configured minimum threshold constraint. If a digit is set to 0, the active internal command remains clamped to the respective minimum mapping percentage (P4.14 or P4.19). If a digit is set to 1, dropping below the minimum voltage forces the internal processed command immediately down to 0.0%.

P4.35	**X1 delay time**		**Default**	**0.0 s**
	Setting range	0.0 s–3600.0 s		
P4.36	**X2 delay time**		**Default**	**0.0 s**
	Setting range	0.0 s–3600.0 s		
P4.37	**X3 delay time**		**Default**	**Reserved**
	Setting range	0.0 s–3600.0 s		

Description (P4.35 to P4.37):

These parameters define a dedicated digital input validation delay filter when the physical hardware terminal changes its open/closed state. Currently, the hardware circuit layer restricts this specific time delay functionality to terminals X1 and X2.

P4.38	**X valid mode selection 1**		**Default**	**00000**
	Setting range	**Unit's digit**	**X1 valid mode**	
		0	High level active (Active High)	
		1	Low level active (Active Low)	
		Ten's digit	**X2 valid mode** (0-1, same as X1)	
		Hundred's digit	**Reserved**	
		Thousand's digit	**Reserved**	
		Ten-thousand's digit	**X5 valid mode** (0-1, same as X1)	

Description:

Configures the dynamic electrical input logic polarity for the digital hardware terminals.

- High level active (0): Terminal triggers active states when connected to COM (closed circuit). Disconnected means inactive.
- Low level active (1): Terminal triggers active states when disconnected from COM (open circuit). Connected to COM means inactive.

P4.39	**X valid mode selection 2**		**Default**	**00000**
	Setting range	**Unit's digit**	**Reserved**	
		Ten's digit	**Reserved**	
		Hundred's digit	**Reserved**	
		Thousand's digit	**Reserved**	
		Ten-thousand's digit	Reserved	

Description:

Configures the dynamic electrical input logic polarity for the digital hardware terminals.

- High level active (0): Terminal triggers active states when connected to COM (closed circuit). Disconnected means inactive.
- Low level active (1): Terminal triggers active states when disconnected from COM (open circuit). Connected to COM means inactive.

6.6 Group P5: Output Terminals

The Velron VCD100 series provides 1 multi-function analog output terminal FOV. It features 1 multi-function relay output, alongside a standard transistor output terminal.

P5.00	**MO1 terminal output mode**		**Default**	**0**
	Setting range	**0**	Pulse output (MO1-COM)	
		1	Digital output (MOA-MOB-MOC on expansion card)	

Description:

MO1 is a programmable multiplex terminal. It can be used as a high-speed pulse output (MO1-COM) or as an open-collector switch output (MOA-MOB-MOC). When used as a pulse output, the maximum frequency of the output pulses is 100 kHz. The function of the pulse output MO1-COM is selected with P5.06.

P5.01	**Digital output function selection (MOA-MOB-MOC / MO1)**		**Default**	**0**
	Setting range	0–41		
P5.02	**Relay function selection (YA-YB-YC)**		**Default**	**2**
	Setting range	0–41		
P5.03	**Relay function selection (TA-TC)**		**Default**	**0**
	Setting range	0–41		
P5.04	**YO terminal output function selection**		**Default**	**1**
	Setting range	0–41		

Description (P5.01 to P5.04):

These parameters select the functions of the digital output terminals. The functions are described in the following table.

Multi-Function Digital Output Assignment Matrix:

Value	Function	Functional Description
0	No output	The terminal has no function.
1	AC drive running	The terminal switches ON when the AC drive is running and outputs a frequency (can be 0 Hz).
2	Fault output (stop)	The terminal switches ON when the AC drive stops due to a fault.
3	Frequency-level detection FDT1	See the descriptions of P8.19 and P8.20.
4	Frequency reached	See the description of P8.21.
5	Zero-speed running (no output at stop)	The terminal switches ON when the AC drive is running with an output frequency of 0 Hz. In the stop state the terminal is OFF.
6	Motor overload pre-warning	Before the motor overload protection trips, the AC drive checks whether the motor load exceeds the pre-warning threshold. If the threshold is exceeded, the terminal switches ON. For the motor overload parameters, see P9.00 to P9.02.
7	AC drive overload pre-warning	The terminal switches ON 10 s before the AC drive overload protection trips.
8	Set count value reached	The terminal switches ON when the count value reaches the set count value.
9	Designated count value reached	The terminal switches ON when the count value reaches the designated count value.
10	Length reached	The terminal switches ON when the detected actual length exceeds the set length.
11	PLC cycle complete	When the simple PLC has completed one cycle, the terminal outputs a pulse with a width of 250 ms.
12	Accumulative running time reached	The terminal switches ON when the accumulative running time of the AC drive exceeds the time set in P8.17.
13	Frequency limited	The terminal switches ON when the set frequency exceeds the upper or lower frequency limit and the output frequency reaches that limit.
14	Torque limited	In speed control mode, if the output torque reaches the torque limit, the AC drive enters stall protection and the terminal switches ON.
15	Ready for RUN	The terminal switches ON when the main circuit and the control circuit are stable, no fault is detected and the AC drive is ready to run.

Value	Function	Functional Description
16	FIV > FIC	The terminal switches ON when the input signal at FIV is larger than the input signal at FIC.
17	Frequency upper limit reached	The terminal switches ON when the running frequency reaches the upper frequency limit.
18	Frequency lower limit reached (no output at stop)	The terminal switches ON when the running frequency reaches the lower frequency limit. In the stop state the terminal is OFF.
19	Undervoltage state	The terminal switches ON when the AC drive is in the undervoltage state.
20	Communication setting	See the communication protocol.
21	Reserved	Reserved
22	Reserved	Reserved
23	Zero-speed running 2 (output also at stop)	The terminal switches ON when the output frequency is 0 Hz. The signal remains ON in the stop state.
24	Accumulative power-on time reached	The terminal switches ON when the accumulative power-on time (P7.13) exceeds the value set in P8.16.
25	Frequency-level detection FDT2	See the descriptions of P8.28 and P8.29.
26	Frequency 1 reached	See the descriptions of P8.30 and P8.31.
27	Frequency 2 reached	See the descriptions of P8.32 and P8.33.
28	Current 1 reached	See the descriptions of P8.38 and P8.39.
29	Current 2 reached	See the descriptions of P8.40 and P8.41.
30	Timing reached	If the timing function (P8.42) is active, the terminal switches ON as soon as the current running time reaches the set time.
31	FIV input limit exceeded	The terminal switches ON when the signal at FIV is larger than P8.46 (FIV input voltage upper limit) or smaller than P8.45 (lower limit).
32	Load becoming 0 (load loss)	The terminal switches ON when the load drops to 0.
33	Reverse running	The terminal switches ON when the AC drive is running in reverse.
34	Zero current state	See the descriptions of P8.34 and P8.35.
35	Module temperature reached	The terminal switches ON when the heatsink temperature of the inverter module (P7.07) reaches the set threshold (P8.47).

Value	Function	Functional Description
36	Software current limit exceeded	See the descriptions of P8.36 and P8.37.
37	Frequency lower limit reached (output also at stop)	The terminal switches ON when the running frequency reaches the lower frequency limit. The signal remains ON in the stop state.
38	Alarm output	If a fault occurs and the AC drive continues to run, the terminal outputs an alarm signal.
39	Motor overheat pre-warning	The terminal outputs a pre-warning before the motor overheats.
40	Current running time reached	The terminal switches ON when the current running time of the AC drive exceeds the value of P8.53.
41	Fault output (no output at undervoltage)	The terminal switches ON when a fault occurs. There is no output at undervoltage.

P5.06	**MO1 pulse output function selection**	**Default**	**0**
	Setting range	0–16	
P5.07	**FOV analog output function selection**	**Default**	**0**
	Setting range	0–16	
P5.08	**FOC (expansion card) analog output function selection**	**Default**	**1**
	Setting range	0–16	

Description (P5.06 to P5.08):

The pulse output MO1 outputs frequencies from 0.01 kHz up to the value of P5.09 (MO1 output maximum frequency). P5.09 can be set from 0.01 kHz to 100.00 kHz.
The output range of the analog outputs FOV and FOC is 0 V–10 V or 0 mA–20 mA. The following table shows the range that the pulse or analog output (0.0% to 100.0%) represents for each function.

Analog and Pulse Output Assignment Matrix:

Value	Function	Range (corresponds to 0.0%–100.0% of the pulse or analog output)
0	Running frequency	0 to maximum output frequency
1	Set frequency	0 to maximum output frequency
2	Output current	0 to 2 times the rated motor current
3	Output torque	0 to 2 times the rated motor torque
4	Output power	0 to 2 times the rated power
5	Output voltage	0 to 1.2 times the rated AC drive voltage
6	Pulse input	0.01 kHz–100.00 kHz
7	FIV	0 V–10 V
8	FIC	0 V–10 V (or 0 mA–20 mA)
9	Reserved	–
10	Length	0 to maximum set length
11	Count value	0 to maximum count value
12	Communication setting	0.0%–100.0%
13	Motor rotational speed	0 to rotational speed at maximum output frequency
14	Output current	0.0 A–1000.0 A
15	Output voltage	0.0 V–1000.0 V
16	Output torque (actual value)	Actual value in percent, relative to the motor

P5.09	**MO1 output maximum frequency**	**Default**	**50.00 kHz**
	Setting range	0.01 kHz–100.00 kHz	

Description:

When the MO1 terminal is used as a pulse output, this parameter sets the maximum frequency of the output pulses.

P5.10	**FOV zero offset coefficient**	**Default**	**0.0%**
	Setting range	-100.0% to +100.0%	
P5.11	**FOV gain**	**Default**	**1.00**
	Setting range	-10.00 to +10.00	
P5.12	**FOC zero offset coefficient**	**Default**	**0.0%**
	Setting range	-100.0% to +100.0%	
P5.13	**FOC gain**	**Default**	**1.00**
	Setting range	-10.00 to +10.00	

Description (P5.10 to P5.13):

These parameters correct the zero drift and the output amplitude deviation of the analog outputs. They can also be used to define a custom output curve for FOV or FOC.
With b = zero offset, k = gain, Y = actual output and X = standard output, the actual output is: Y = kX + b.
A zero offset of 100% corresponds to 10 V (or 20 mA). The standard output is the output value of 0 V to 10 V (or 0 mA to 20 mA) without zero offset and gain.
Example: The analog output shall output the running frequency, with 8 V at 0 Hz and 3 V at the maximum frequency. For this, set the gain to -0.50 and the zero offset to 80%.

P5.17	**MOA-MOB-MOC / MO1 output delay time**	**Default**	**0.0 s**
	Setting range	0.0 s–3600.0 s	
P5.18	**YA-YB-YC output delay time**	**Default**	**0.0 s**
	Setting range	0.0 s–3600.0 s	
P5.19	**TA-TC output delay time**	**Default**	**0.0 s**
	Setting range	0.0 s–3600.0 s	
P5.20	**YO output delay time**	**Default**	**0.0 s**
	Setting range	0.0 s–3600.0 s	

Description (P5.17 to P5.20):

These parameters set the delay time between the status change of an output function and the actual switching of the output terminal or relay.

P5.22	**Output terminal valid mode selection**		**Default**	**00000**
	Setting range	**Unit's digit**	**MOA-MOB-MOC / MO1 valid mode**	
		0	Positive logic	
		1	Negative logic	
		Ten's digit	**YA-YB-YC valid mode (0-1, same as MOA-MOB-MOC / MO1)**	
		Hundred's digit	**TA-TC valid mode (0-1, same as MOA-MOB-MOC / MO1)**	
		Thousand's digit	**YO valid mode (0-1, same as MOA-MOB-MOC / MO1)**	

Description:

Defines for the digital outputs which switching state counts as active.
Positive logic (0): The output is active when it is connected to its common terminal and inactive when the connection is open.
Negative logic (1): The output is inactive when it is connected to its common terminal and active when the connection is open.

6.7 Group P6: Start/Stop Control

This group sets the start and stop behaviour of the AC drive, the acceleration/deceleration curve and DC braking at start and stop.

P6.00	**Start mode**		**Default**	**0**
	Setting range	**0**	Direct start	
		1	Rotational speed tracking restart	
		2	Pre-excited start (asynchronous motor)	

Description:

Direct start (0): If the startup DC braking time (P6.06) is set to 0, the AC drive starts to run at the startup frequency. If it is not 0, the AC drive performs DC braking first and then starts to run at the startup frequency. Suitable for small-inertia loads where the motor may still be rotating at startup.
Rotational speed tracking restart (1): The AC drive first determines the rotational speed and direction of the motor and then starts at the tracked frequency. This gives a smooth start without impact on the rotating motor. Suitable for restart after an instantaneous power failure with large-inertia loads. For reliable speed tracking, the motor parameters in group P1 must be set correctly.
Pre-excited start (2): Valid only for asynchronous motors. The magnetic field is built up in the motor before it runs. The pre-excitation current and time are set in P6.05 and P6.06. If the pre-excitation time is 0, pre-excitation is cancelled and the AC drive starts at the startup frequency. If it is not 0, the AC drive pre-excites first and then starts, which improves the dynamic response of the motor.

P6.01	**Rotational speed tracking mode**		**Default**	**0**
	Setting range	**0**	From frequency at stop	
		1	From zero speed	
		2	From maximum frequency	

Description:

To complete the speed tracking process in the shortest possible time, select the frequency from which the AC drive searches for the motor speed.
From frequency at stop (0): The search starts at the frequency present at stop. This is the usual setting.
From zero speed (1): The search starts at 0 Hz. Suitable for restart after a long power failure.
From maximum frequency (2): The search starts at the maximum frequency. Suitable for regenerative loads.

P6.02	**Rotational speed tracking speed**		**Default**	**20**
	Setting range	1–100		

Description:

Sets how fast the AC drive searches for the motor speed during speed tracking restart. The larger the value, the faster the tracking. However, a value that is too large may cause unreliable tracking.

P6.03	**Startup frequency**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz–10.00 Hz	
P6.04	**Startup frequency holding time**	**Default**	**0.0 s**
	Setting range	0.0 s–100.0 s	

Description (P6.03 and P6.04):

To ensure sufficient motor torque at startup, set a suitable startup frequency. To build up the magnetic field at startup, the startup frequency is also held for a certain time.
The startup frequency (P6.03) is not limited by the frequency lower limit. If the target frequency is lower than the startup frequency, the AC drive does not start and stays in the standby state.
During switchover between forward and reverse rotation, the startup frequency holding time is disabled. The holding time is not included in the acceleration time but is included in the running time of the simple PLC.
Example 1: P0.03 = 0 (frequency source digital setting), P0.08 = 2.00 Hz (digital frequency setting), P6.03 = 5.00 Hz (startup frequency), P6.04 = 2.0 s (startup frequency holding time). As the set frequency is below the startup frequency, the AC drive stays in the standby state and the output frequency is 0.00 Hz.
Example 2: P0.03 = 0, P0.08 = 10.00 Hz, P6.03 = 5.00 Hz, P6.04 = 2.0 s. The AC drive accelerates to 5.00 Hz, holds this frequency for 2 s and then accelerates to the set frequency of 10.00 Hz.

P6.05	**Startup DC braking current / Pre-excitation current**	**Default**	**0%**
	Setting range	0%–100%	
P6.06	**Startup DC braking time / Pre-excitation time**	**Default**	**0.0 s**
	Setting range	0.0 s–100.0 s	

Description (P6.05 and P6.06):

Startup DC braking is generally used to stop a still rotating motor before the AC drive restarts. Pre-excitation builds up the magnetic field in the asynchronous motor before startup to improve the response.
Startup DC braking is valid only for direct start (P6.00 = 0). The AC drive brakes with the set startup DC braking current and starts to run after the startup DC braking time. If the startup DC braking time is 0, the AC drive starts directly without DC braking. The larger the DC braking current, the larger the braking force.
With pre-excited start (P6.00 = 2), the AC drive builds up the magnetic field with the set pre-excitation current and starts to run after the pre-excitation time. If the pre-excitation time is 0, the AC drive starts directly without pre-excitation.
The startup DC braking current and the pre-excitation current are percentages of the base value (for the base value, see the description of P6.13).

P6.07	**Acceleration/deceleration mode**		**Default**	**0**
	Setting range	**0**	Linear acceleration/deceleration	
		1	S-curve acceleration/deceleration A	
		2	S-curve acceleration/deceleration B	

Description:

Sets how the frequency changes during the start and stop process of the AC drive.
Linear acceleration/deceleration (0): The output frequency increases or decreases linearly. The VCD100 provides four sets of acceleration/deceleration times, which can be selected via the digital inputs (group P4).
S-curve acceleration/deceleration A (1): The output frequency increases or decreases along an S-curve. The S-curve is used where a smooth start or stop is required, e.g. for elevators or conveyor belts. P6.08 and P6.09 define the time proportions of the start and end segments of the S-curve.
S-curve acceleration/deceleration B (2): In this curve, the rated motor frequency fb is always the inflection point. It is usually used in applications where acceleration/deceleration above the rated frequency is required.
If the set frequency is higher than the rated frequency, the acceleration/deceleration time is (see Figure 6.12): $t = (4/9 \times (f / fb)^2 + 5/9) \times T$, where f is the set frequency, fb is the rated motor frequency and T is the acceleration time from 0 Hz to the rated frequency fb.

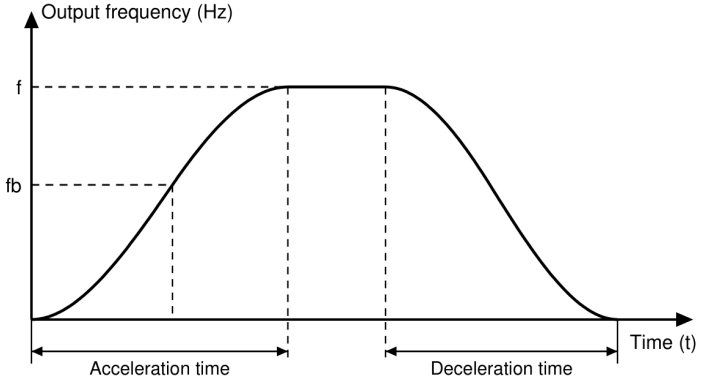


Figure 6.12 - S-curve acceleration/deceleration B

P6.08	**Time proportion of S-curve start segment**		**Default**	**30.0%**
	Setting range	0.0% to (100.0% – P6.09)		
P6.09	**Time proportion of S-curve end segment**		**Default**	**30.0%**
	Setting range	0.0% to (100.0% – P6.08)		

Description (P6.08 and P6.09):

These parameters define the time proportions of the start segment and the end segment of S-curve A. They must satisfy: P6.08 + P6.09 ≤ 100.0%.

In Figure 6.13, t1 is the time defined in P6.08, during which the slope of the output frequency gradually increases. t2 is the time defined in P6.09, during which the slope gradually decreases to 0. Between t1 and t2 the slope remains constant, i.e. the frequency changes linearly.

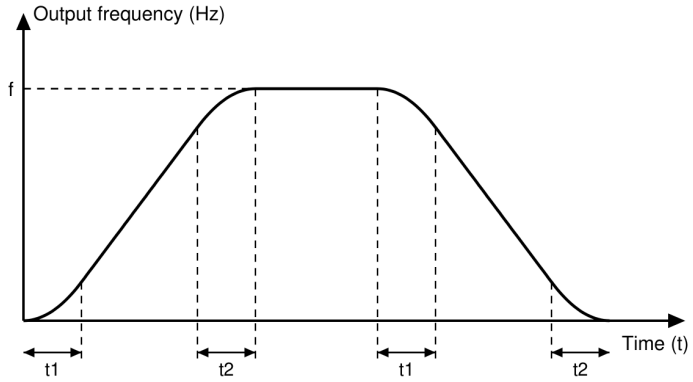


Figure 6.13 - S-curve acceleration/deceleration A

P6.10	**Stop mode**		**Default**	**0**
	Setting range	**0**	Decelerate to stop	
		1	Coast to stop	

Description:

Decelerate to stop (0): After the stop command, the AC drive reduces the output frequency according to the deceleration time and stops when the frequency reaches 0.
Coast to stop (1): After the stop command, the AC drive immediately blocks its output. The motor coasts to a stop according to its mechanical inertia.

P6.11	**Initial frequency of stop DC braking**		**Default**	**0.00 Hz**
	Setting range	0.00 Hz to maximum frequency		
P6.12	**Waiting time of stop DC braking**		**Default**	**0.0 s**
	Setting range	0.0 s–100.0 s		
P6.13	**Stop DC braking current**		**Default**	**0%**
	Setting range	0%–100%		
P6.14	**Stop DC braking time**		**Default**	**0.0 s**
	Setting range	0.0 s–100.0 s		

Description (P6.11 to P6.14):

Initial frequency of stop DC braking (P6.11): When decelerating to stop, the AC drive starts DC braking as soon as the running frequency falls below the value of P6.11.
Waiting time of stop DC braking (P6.12): When the running frequency reaches the initial frequency of stop DC braking, the AC drive blocks its output for this time and only then starts DC braking. This prevents faults such as overcurrent caused by DC braking at high speed.
Stop DC braking current (P6.13): Sets the output current during DC braking as a percentage of the base value. If the rated motor current is less than or equal to 80% of the rated AC drive current, the base value is the rated motor current. If the rated motor current is greater than 80% of the rated AC drive current, the base value is 80% of the rated AC drive current.

Stop DC braking time (P6.14): Sets how long DC braking lasts. If it is set to 0, DC braking is cancelled. The process is shown in Figure 6.14.

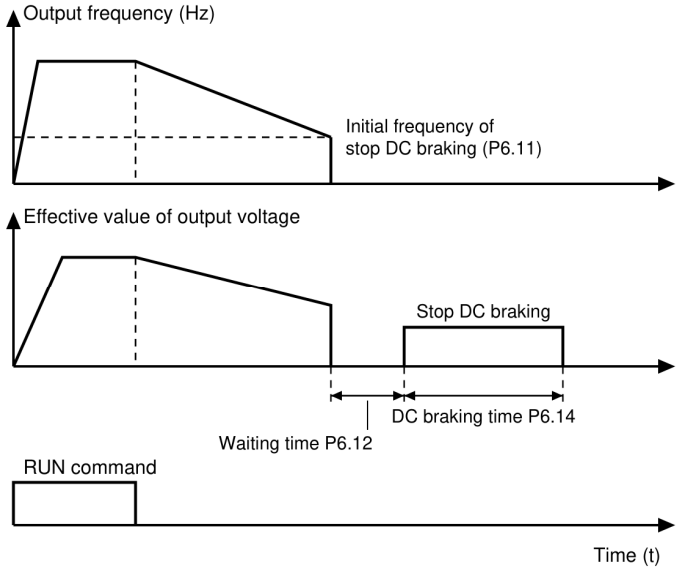


Figure 6.14 - Stop DC braking

P6.15	Braking unit duty ratio		Default	100%
	Setting range	0%–100%		

Description:

Valid only for AC drives with a built-in braking unit (brake chopper). Sets the duty ratio of the braking unit. The larger the value, the stronger the braking effect. However, a value that is too large causes large fluctuations of the DC bus voltage during braking.

P6.18	Speed tracking current limit		Default	Model dependent
	Setting range	30%–200%		

Description:

Limits the output current during rotational speed tracking restart (P6.00 = 1).

P6.21	Demagnetization time		Default	Model dependent
	Setting range	0.00 s–5.00 s		

Description:

Sets the time in which the motor is demagnetized after stop before it can be started again. Valid only for sensorless vector control (SVC).

6.8 Group P7: Operation Panel and Display

This group sets the functions of the JOG and STOP/RESET keys and the parameters shown on the operation panel. It also contains display values such as temperatures, operating times and software versions.

P7.01	**JOG key function selection**		**Default**	**0**
	Setting range	**0**	No function	
		1	Switchover between operation panel control and remote command control (terminal or communication)	
		2	Switchover between forward and reverse rotation	
		3	Forward JOG	
		4	Reverse JOG	

Description:

The JOG key is a multi-function key whose function is set with this parameter. The switchover is possible both at stop and during running.
No function (0): The JOG key has no effect.
Switchover operation panel/remote control (1): The command source is switched between the current command source (terminal or communication) and the operation panel. If the operation panel is already the command source, the key has no effect.
Switchover forward/reverse rotation (2): The JOG key switches the direction of the frequency command. Valid only when the operation panel is the command source.
Forward JOG (3) / Reverse JOG (4): The JOG key performs forward jogging (JOG-FWD) or reverse jogging (JOG-REV).

P7.02	**STOP/RESET key function**		**Default**	**1**
	Setting range	**0**	Valid only in operation panel control	
		1	Valid in any operation mode	

Description:

Sets whether the STOP/RESET key is valid only in operation panel control (0) or in any operation mode, i.e. also with terminal or communication control (1).

P7.03	**LED display running parameters 1**		**Default**	**1F**
	Setting range	0000–FFFF		
P7.04	**LED display running parameters 2**		**Default**	**0**
	Setting range	0000–FFFF		

Description (P7.03 and P7.04):

P7.03 and P7.04 select the parameters that can be viewed on the operation panel during running. A total of 32 display values is available. The display starts with the lowest bit of P7.03.
To display a parameter, set the corresponding bit to 1 and enter the resulting binary number as a hexadecimal value in P7.03 or P7.04.

Example: The factory setting P7.03 = 1F corresponds to the binary number 0000 0000 0001 1111. Bit00 to Bit04 are set, so output frequency, set frequency, DC bus voltage, output voltage and output current are displayed.

Display values P7.03 (running parameters 1):

Bit	Displayed value	Unit
Bit00	Operating frequency 1	Hz
Bit01	Set frequency	Hz
Bit02	DC bus voltage	V
Bit03	Output voltage	V
Bit04	Output current	A
Bit05	Output power	kW
Bit06	Output torque	%
Bit07	Input terminal status	–
Bit08	Output terminal status	–
Bit09	FIV voltage	V
Bit10	FIC voltage	V
Bit11	Reserved	–
Bit12	Count value	–
Bit13	Length value	–
Bit14	Load speed display	–
Bit15	PID setting	–

Display values P7.04 (running parameters 2):

Bit	Displayed value	Unit
Bit00	PID feedback	–
Bit01	PLC stage	–
Bit02	PULSE input pulse frequency	kHz
Bit03	Motor speed	rpm
Bit04	Remaining running time	–
Bit05	FIV voltage before calibration (extension card)	V
Bit06	FIC voltage before correction	V

Bit	Displayed value	Unit
Bit07	Reserved	–
Bit08	Motor speed	–
Bit09	Current power-on time	h
Bit10	Current running time	min
Bit11	PULSE input pulse frequency	Hz
Bit12	Communication set value	–
Bit13	Encoder feedback speed	Hz
Bit14	Main frequency X	Hz
Bit15	Auxiliary frequency Y	Hz

P7.05	**LED display stop parameters**	**Default**	**33**
	Setting range	0000–FFFF	

Description:

P7.05 selects the parameters displayed on the operation panel at stop. The setting is made as for P7.03: set the bit of each parameter to be displayed to 1 and enter the binary number as a hexadecimal value.

Display values P7.05 (stop parameters):

Bit	Displayed value	Unit
Bit00	Set frequency	Hz
Bit01	DC bus voltage	V
Bit02	DI input status	–
Bit03	DO output status	–
Bit04	FIV voltage	V
Bit05	FIC voltage	V
Bit06	Reserved	–
Bit07	Count value	–
Bit08	Length value	–
Bit09	PLC stage	–
Bit10	Load speed	–

Bit	Displayed value	Unit
Bit11	PID setting	–
Bit12	Pulse setting frequency	kHz

P7.06	**Load speed display coefficient**	**Default**	**1.0000**
	Setting range	0.0001–6.5000	

Description:

Sets the relationship between the output frequency of the AC drive and the displayed load speed. For details, see the description of P7.12.

P7.07	**Heatsink temperature of inverter module**	**Default**	**–**
	Setting range	0.0 °C–120.0 °C	
P7.08	**Heatsink temperature of rectifier module**	**Default**	**–**
	Setting range	0.0 °C–120.0 °C	

Description (P7.07 and P7.08):

P7.07 displays the IGBT temperature of the inverter module. The overtemperature protection value of the inverter module depends on the model.
P7.08 displays the temperature of the rectifier module. The overtemperature protection value differs depending on the module.
Both parameters are display values only and cannot be changed.

P7.09	**Accumulative running time**	**Default**	**–**
	Setting range	0 h–65535 h	

Description:

Displays the accumulative running time of the AC drive. When the accumulative running time reaches the value set in P8.17, a digital output with function 12 (accumulative running time reached) switches ON.

P7.10	**Performance software version**	**Default**	**–**
	Setting range	Display only	
P7.11	**Control board software version**	**Default**	**–**
	Setting range	Display only	

Description (P7.10 and P7.11):

Display the software versions of the AC drive.

P7.12	**Number of decimal places for load speed display**		**Default**	**21**
	Setting range	**Unit's digit**	**Decimal places for d0.14 (load speed)**	
		0	No decimal place	
		1	1 decimal place	
		2	2 decimal places	
		3	3 decimal places	
		Ten's digit	**Decimal places for d0.19 / d0.29**	
		1	1 decimal place	
		2	2 decimal places	

Description:

Unit's digit: Sets the number of decimal places of the load speed display. Example: P7.06 (load speed display coefficient) = 2.000 and unit's digit of P7.12 = 2 (2 decimal places). When the AC drive runs at 40.00 Hz, the displayed load speed is 40.00 × 2.000 = 80.00.
At stop, the load speed corresponding to the set frequency is displayed (set load speed). With a set frequency of 50.00 Hz, it is 50.00 × 2.000 = 100.00 at stop.
Ten's digit: Sets whether d0.19 and d0.29 are displayed with 1 or 2 decimal places.

P7.13	**Accumulative power-on time**		**Default**	**–**
	Setting range	0 h–65535 h		

Description:

Displays the accumulative power-on time of the AC drive since delivery. When it reaches the value set in P8.16, a digital output with function 24 (accumulative power-on time reached) switches ON.

P7.14	**Accumulative power consumption**		**Default**	**–**
	Setting range	0 kWh–65535 kWh		

Description:

Displays the accumulative power consumption of the AC drive up to now.

6.9 Group P8: Auxiliary Functions

This group sets jogging, further acceleration/deceleration times, jump frequencies and various detection and monitoring functions whose status can be output via the digital outputs (group P5).

P8.00	**JOG running frequency**		**Default**	**2.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)		
P8.01	**JOG acceleration time**		**Default**	**20.0 s**
	Setting range	0.0 s–6500.0 s		
P8.02	**JOG deceleration time**		**Default**	**20.0 s**
	Setting range	0.0 s–6500.0 s		

Description (P8.00 to P8.02):

These parameters define the set frequency and the acceleration/deceleration time of the AC drive when jogging.
During jogging, the start mode is always "Direct start" (P6.00 = 0) and the stop mode "Decelerate to stop" (P6.10 = 0).

P8.03	**Acceleration time 2**		**Default**	**Model dependent**
	Setting range	0.0 s–6500.0 s		
P8.04	**Deceleration time 2**		**Default**	**Model dependent**
	Setting range	0.0 s–6500.0 s		
P8.05	**Acceleration time 3**		**Default**	**Model dependent**
	Setting range	0.0 s–6500.0 s		
P8.06	**Deceleration time 3**		**Default**	**Model dependent**
	Setting range	0.0 s–6500.0 s		
P8.07	**Acceleration time 4**		**Default**	**Model dependent**
	Setting range	0.0 s–6500.0 s		
P8.08	**Deceleration time 4**		**Default**	**Model dependent**
	Setting range	0.0 s–6500.0 s		

Description (P8.03 to P8.08):

The VCD100 provides four sets of acceleration/deceleration times: the three sets of these parameters and the set defined by P0.17 and P0.18. All four sets are defined in the same way. They are selected via the states of the digital inputs with functions 16 and 17 (see group P4).

P8.09	**Jump frequency 1**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	
P8.10	**Jump frequency 2**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	
P8.11	**Frequency jump amplitude**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	

Description (P8.09 to P8.11):

If the set frequency is within a frequency jump range, the AC drive runs at the jump frequency closest to the set frequency. Jump frequencies help to avoid mechanical resonance points of the load.

The VCD100 supports two jump frequencies. If both are set to 0, the function is disabled. Figure 6.15 shows the principle.

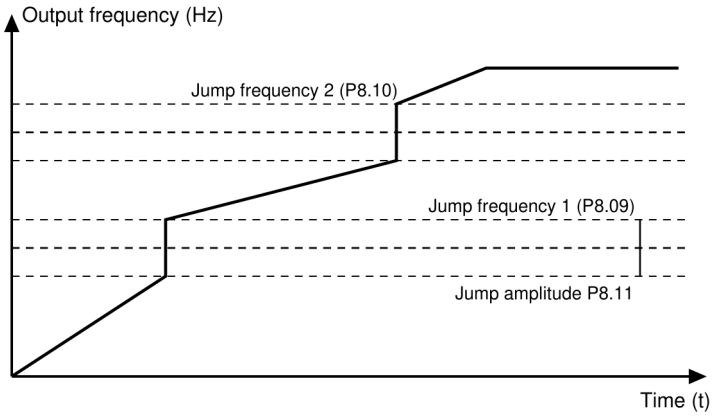


Figure 6.15 - Jump frequencies and jump amplitude

P8.12	**Forward/reverse rotation dead-zone time**	**Default**	**0.0 s**
	Setting range	0.0 s–3000.0 s	

Description:

Sets the time for which the AC drive outputs 0 Hz during the transition between forward and reverse rotation (see Figure 6.16).

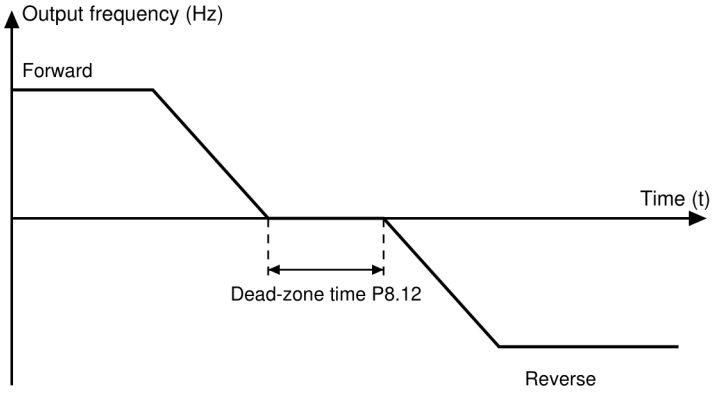


Figure 6.16 - Forward/reverse rotation dead-zone time

P8.13	**Reverse control**		**Default**	**0**
	Setting range	**0**	Reverse rotation enabled	
		1	Reverse rotation disabled	

Description:

Sets whether the AC drive may run in reverse. In applications where reverse rotation is not allowed, set P8.13 = 1.

P8.14	**Running mode when set frequency is lower than frequency lower limit**		**Default**	**0**
	Setting range	**0**	Run at frequency lower limit	
		1	Stop	
		2	Run at zero speed	

Description:

Sets the behaviour of the AC drive when the set frequency is lower than the frequency lower limit.

P8.15	**Droop control**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz–10.00 Hz	

Description:

Used for load sharing when several motors drive the same load. The output frequency of the AC drive decreases as the load increases. This relieves the more heavily loaded motor and balances the load between the motors.

P8.16	**Accumulative power-on time threshold**		**Default**	**0 h**
	Setting range	0 h–65000 h		
P8.17	**Accumulative running time threshold**		**Default**	**0 h**
	Setting range	0 h–65000 h		

Description (P8.16 and P8.17):

When the accumulative power-on time (P7.13) reaches the value of P8.16, a digital output with function 24 (accumulative power-on time reached) switches ON.
When the accumulative running time (P7.09) reaches the value of P8.17, a digital output with function 12 (accumulative running time reached) switches ON.

P8.18	**Startup protection**		**Default**	**0**
	Setting range	**0**	Disabled	
		1	Enabled	

Description:

Sets whether startup protection is enabled. With P8.18 = 1, the AC drive does not respond to a running command that is already present at power-on (e.g. an input that is ON before power-on). The AC drive responds only after the running command has been cancelled and given again. Likewise, the AC drive does not respond to a running command present at fault reset. Startup protection is only cancelled when the running command is removed.
With P8.18 = 1, the motor is thus prevented from starting unexpectedly after power-on or fault reset.

P8.19	**Frequency detection value (FDT1)**	**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	
P8.20	**Frequency detection hysteresis (FDT1)**	**Default**	**5.0%**
	Setting range	0.0%–100.0% (FDT1 level)	

Description (P8.19 and P8.20):

If the running frequency is higher than the detection value P8.19, a digital output with function 3 (frequency level detection FDT1) switches ON. When the running frequency falls below the detection value minus the hysteresis, the output switches OFF.
P8.20 is the hysteresis as a percentage of the detection value P8.19 (see Figure 6.17).

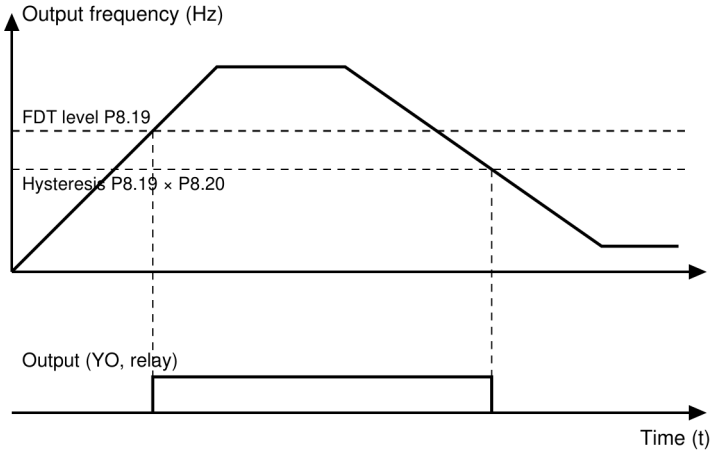


Figure 6.17 - Frequency level detection FDT

P8.21	**Detection range of frequency reached**	**Default**	**0.0%**
	Setting range	0.0%–100.0% (maximum frequency)	

Description:

If the running frequency is within this range around the set frequency, a digital output with function 4 (frequency reached) switches ON. The value is a percentage of the maximum frequency (see Figure 6.18).

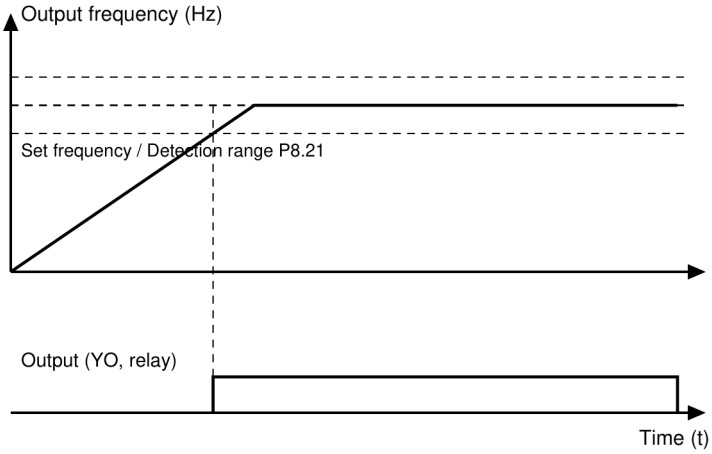


Figure 6.18 - Detection range of frequency reached

P8.22	**Jump frequency during acceleration/deceleration**	**Default**	**0**
	Setting range **0**	Disabled	
	1	Enabled	

Description:

Sets whether the jump frequencies are also valid during acceleration and deceleration. If enabled and the running frequency reaches a jump range, the frequency jumps over the range, i.e. directly from its lower to its upper limit (see Figure 6.15).

P8.25	**Frequency switchover point between acceleration time 1 and 2**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	
P8.26	**Frequency switchover point between deceleration time 1 and 2**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	

Description (P8.25 and P8.26):

This function is valid when the acceleration/deceleration time is not switched via the digital inputs. The time is then selected depending on the running frequency (see Figure 6.19).
During acceleration, acceleration time 2 applies below P8.25 and acceleration time 1 above it.

During deceleration, deceleration time 1 applies above P8.26 and deceleration time 2 below it.

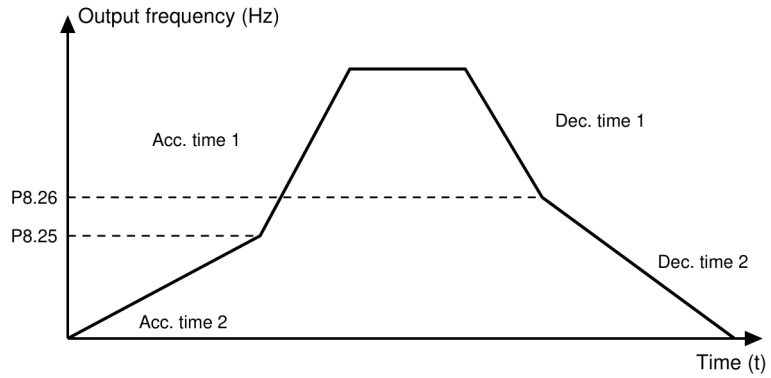


Figure 6.19 - Acceleration/deceleration time switchover

P8.27	**Terminal JOG preferred**		**Default**	**0**
	Setting range	**0**	Disabled	
		1	Enabled	

Description:

Sets whether terminal JOG has the highest priority. If enabled, the AC drive switches to jogging when a terminal JOG command is given, also during running.

P8.28	**Frequency detection value (FDT2)**	**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)	
P8.29	**Frequency detection hysteresis (FDT2)**	**Default**	**5.0%**
	Setting range	0.0%–100.0% (FDT2 level)	

Description (P8.28 and P8.29):

Same function as FDT1 (see P8.19 and P8.20). The output is a digital output with function 25 (frequency level detection FDT2).

P8.30	**Any frequency reaching detection value 1**		**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)		
P8.31	**Any frequency reaching detection amplitude 1**		**Default**	**0.0%**
	Setting range	0.0%–100.0% (maximum frequency)		
P8.32	**Any frequency reaching detection value 2**		**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)		
P8.33	**Any frequency reaching detection amplitude 2**		**Default**	**0.0%**
	Setting range	0.0%–100.0% (maximum frequency)		

Description (P8.30 to P8.33):

If the output frequency is within the amplitude around the detection value, a digital output with function 26 (frequency 1 reached) or 27 (frequency 2 reached) switches ON. The VCD100 provides two such detections (see Figure 6.20).

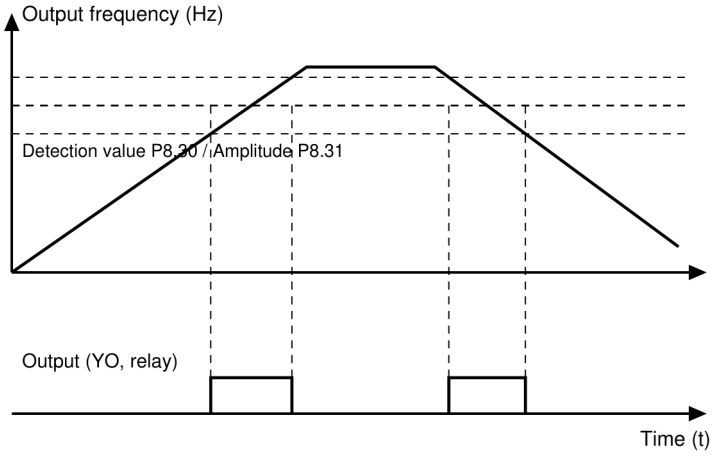


Figure 6.20 - Any frequency reaching detection

P8.34	**Zero current detection level**	**Default**	**5.0%**
	Setting range	0.0%–300.0% (100.0% = rated motor current)	
P8.35	**Zero current detection delay time**	**Default**	**0.10 s**
	Setting range	0.01 s–600.00 s	

Description (P8.34 and P8.35):

If the output current is equal to or less than the zero current detection level for longer than the delay time, a digital output with function 34 (zero current state) switches ON (see Figure 6.21).

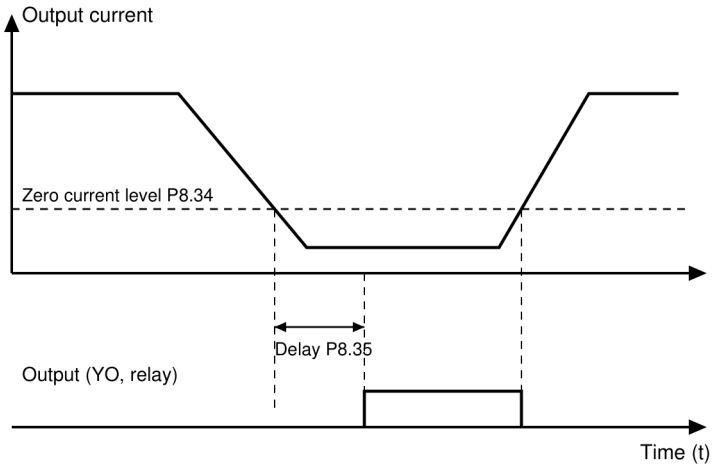


Figure 6.21 - Zero current detection

P8.36	**Output overcurrent threshold**	**Default**	**200.0%**
	Setting range	0.0% (no detection), 0.1%–300.0% (rated motor current)	
P8.37	**Output overcurrent detection delay time**	**Default**	**0.00 s**
	Setting range	0.00 s–600.00 s	

Description (P8.36 and P8.37):

If the output current is equal to or higher than the overcurrent threshold for longer than the delay time, a digital output with function 36 (software current limit exceeded) switches ON (see Figure 6.22).

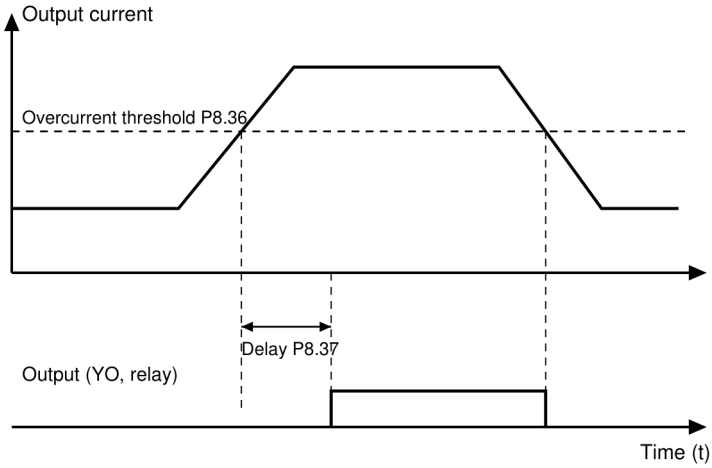


Figure 6.22 - Output overcurrent detection

P8.38	**Any current reaching value 1**	**Default**	**100.0%**
	Setting range	0.0%–300.0% (rated motor current)	
P8.39	**Any current reaching 1 amplitude**	**Default**	**0.0%**
	Setting range	0.0%–300.0% (rated motor current)	
P8.40	**Any current reaching value 2**	**Default**	**100.0%**
	Setting range	0.0%–300.0% (rated motor current)	
P8.41	**Any current reaching 2 amplitude**	**Default**	**0.0%**
	Setting range	0.0%–300.0% (rated motor current)	

Description (P8.38 to P8.41):

If the output current is within the amplitude around the current value, a digital output with function 28 (current 1 reached) or 29 (current 2 reached) switches ON. The VCD100 provides two such detections (see Figure 6.23).

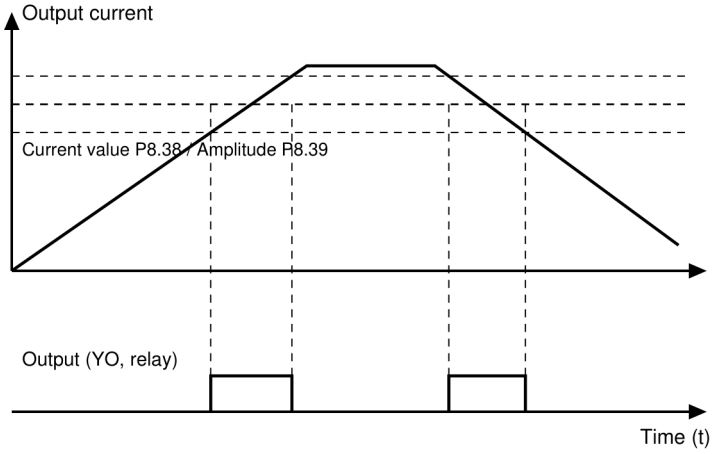


Figure 6.23 - Any current reaching detection

P8.42	**Timing function selection**		**Default**	**0**
	Setting range	**0**	Disabled	
		1	Enabled	
P8.43	**Timing duration source**		**Default**	**0**
	Setting range	**0**	P8.44 setting	
		1	FIV	
		2	FIC	
		3	Reserved	
P8.44	**Timing duration**		**Default**	**0.0 min**
	Setting range	0.0 min–6500.0 min		

Description (P8.42 to P8.44):

These parameters set the timing function. If P8.42 = 1, the timer starts when the AC drive starts. When the set duration is reached, the AC drive stops automatically and a digital output with function 30 (timing reached) switches ON.
The timer starts from 0 at each start. The remaining time can be queried with d0.20. The duration is set in minutes with P8.43 and P8.44. When set via an analog input, 100% of the input corresponds to the value of P8.44.

P8.45	**FIV input voltage lower limit**		**Default**	**3.10 V**
	Setting range	0.00 V to P8.46		
P8.46	**FIV input voltage upper limit**		**Default**	**6.80 V**
	Setting range	P8.45 to 11.00 V		

Description (P8.45 and P8.46):

If the voltage at FIV is higher than P8.46 or lower than P8.45, a digital output with function 31 (FIV input limit exceeded) switches ON. This indicates whether the FIV signal leaves the permissible range.

P8.47	**Module temperature threshold**		**Default**	**75 °C**
	Setting range	0 °C–100 °C		

Description:

When the heatsink temperature of the AC drive reaches this value, a digital output with function 35 (module temperature reached) switches ON.

P8.48	**Cooling fan control**		**Default**	**0**
	Setting range	**0**	Fan working during running	
		1	Fan working continuously	

Description:

Fan working during running (0): The fan runs while the AC drive is running. At stop, it keeps running while the heatsink temperature is above 40 °C and switches off below 40 °C.
Fan working continuously (1): The fan runs continuously after power-on.

P8.49	**Wakeup frequency**	**Default**	**0.00 Hz**
	Setting range	Dormant frequency (P8.51) to maximum frequency (P0.10)	
P8.50	**Wakeup delay time**	**Default**	**0.0 s**
	Setting range	0.0 s–6500.0 s	
P8.51	**Dormant frequency**	**Default**	**0.00 Hz**
	Setting range	0.00 Hz to wakeup frequency (P8.49)	
P8.52	**Dormant delay time**	**Default**	**0.0 s**
	Setting range	0.0 s–6500.0 s	

Description (P8.49 to P8.52):

These parameters set the sleep and wakeup functions, e.g. for water supply applications.
If the AC drive is running and the set frequency is lower than or equal to the dormant frequency (P8.51), it enters the sleep state and stops automatically after the dormant delay time (P8.52).
If the AC drive is in the sleep state, the running command is still active and the set frequency is higher than or equal to the wakeup frequency (P8.49), it starts again after the wakeup delay time (P8.50).
The wakeup frequency should be set higher than or equal to the dormant frequency. If both are set to 0, the function is disabled.
If the frequency source is PID, PA.28 determines whether the PID operation continues in the sleep state. In this case, set PA.28 = 1 (PID operation at stop).

P8.53	**Current running time reached**	**Default**	**0.0 min**
	Setting range	0.0 min–6500.0 min	

Description:

When the current running time reaches this value, a digital output with function 40 (current running time reached) switches ON.

P8.54	**Output power correction coefficient**	**Default**	**100%**
	Setting range	0%–200%	

Description:

Corrects the displayed output power (d0.05) if it does not match the actual value.

6.10 Group P9: Fault and Protection

This group sets the protective functions of the AC drive and displays the last three faults with the related operating data.

P9.00	**Motor overload protection selection**		**Default**	**1**
	Setting range	**0**	Disabled	
		1	Enabled	

P9.01	**Motor overload protection gain**		**Default**	**1.00**
	Setting range	0.20–10.00		

Description (P9.00 and P9.01):

P9.00 = 1: The AC drive judges whether the motor is overloaded according to an inverse time-lag curve (the higher the current, the shorter the permissible time) and reports a motor overload fault if necessary. P9.01 adapts this curve to the actual overload capacity of the motor.
If P9.01 is set too large, the motor may overheat and be damaged without the AC drive reporting a fault.

Note:
With P9.00 = 0, motor overload protection is disabled and the motor may be damaged by overheating. In this case, it is recommended to install a thermal relay (motor protection) between the AC drive and the motor.

P9.02	**Motor overload warning coefficient**		**Default**	**80%**
	Setting range	50%–100%		

Description:

This function warns the control system via a digital output before the motor overload protection trips. P9.02 sets the percentage of the overload curve at which the pre-warning is given. The larger the value, the later the pre-warning.
When the accumulative output current is greater than the overload curve multiplied by P9.02, a digital output with function 6 (motor overload pre-warning) switches ON.

P9.03	**Overvoltage stall gain**		**Default**	**30**
	Setting range	0 (no stall protection)–100		
P9.04	**Overvoltage stall protective voltage**		**Default**	**760.0 V**
	Setting range	200.0 V–2000.0 V		

Description (P9.03 and P9.04):

When the DC bus voltage exceeds P9.04 during deceleration, the AC drive stops decelerating and keeps the present running frequency. When the bus voltage drops again, it continues to decelerate.
P9.03 sets the overvoltage suppression capacity. The larger the value, the greater the suppression. As long as no overvoltage occurs, set a small value.

For small-inertia loads, the value should be small, otherwise the dynamic response becomes slow. For large-inertia loads, the value should be large, otherwise the suppression is poor and an overvoltage fault may occur. With P9.03 = 0, overvoltage stall protection is disabled.



Note:
If a braking resistor is used, P9.03 (overvoltage stall gain) and P2.08 (vector control over-excitation gain) must be set to 0.

P9.07	**Short-circuit to ground upon power-on**		**Default**	**1**
	Setting range	**0**	Disabled	
		1	Enabled	

Description:

Sets whether the motor is checked for short-circuit to ground at power-on. If enabled, voltage is present at the output terminals U, V, W for a short time after power-on.

P9.09	**Fault auto-reset times**	**Default**	**0**
	Setting range	0–20	

P9.10	**MOA-MOB-MOC action during fault auto-reset**		**Default**	**0**
	Setting range	**0**	No action	
		1	Action	

P9.11	**Time interval of fault auto-reset**	**Default**	**1.0 s**
	Setting range	0.1 s–100.0 s	

Description (P9.09 to P9.11):

P9.09 sets how often a fault is reset automatically. If this number is exceeded, the AC drive remains in the fault state.
P9.10 sets whether the MOA-MOB-MOC output switches during fault auto-reset.
P9.11 sets the waiting time between the fault alarm and the automatic fault reset.

P9.12	**Input phase loss / contactor pick-up protection selection**		**Default**	**11**
	Setting range	**Unit's digit**	**Reserved**	
		Ten's digit	**Contactor pick-up protection**	
		0	Disabled	
		1	Enabled	

Description:

Sets whether input phase loss protection and contactor pick-up protection are enabled.

P9.13	Output phase loss protection selection		Default	1
	Setting range	0	Disabled	
		1	Enabled	

Description:

Sets whether output phase loss protection is enabled.

P9.14	1st (oldest) fault type		Default	–
	Setting range	Display only		
P9.15	2nd fault type		Default	–
	Setting range	Display only		
P9.16	3rd (latest) fault type		Default	–
	Setting range	Display only		

Description (P9.14 to P9.16):

Display the types of the last three faults. 0 means: no fault. For causes and solutions of the individual faults, see chapter 8.

Operating data upon the last three faults:

Parameter	Display	Meaning
P9.17	Frequency upon 3rd (latest) fault	Frequency when the latest fault occurred
P9.18	Current upon 3rd fault	Current when the latest fault occurred
P9.19	Bus voltage upon 3rd fault	DC bus voltage when the latest fault occurred
P9.20	Input terminal status upon 3rd fault	Status of the digital inputs as a decimal number (see below)
P9.21	Output terminal status upon 3rd fault	Status of the digital outputs as a decimal number (see below)
P9.22	AC drive status upon 3rd fault	Reserved
P9.23	Power-on time upon 3rd fault	Present power-on time when the latest fault occurred
P9.24	Running time upon 3rd fault	Present running time when the latest fault occurred
P9.27–P9.34	Data of the 2nd fault	Same as P9.17–P9.24
P9.37–P9.44	Data of the 1st (oldest) fault	Same as P9.17–P9.24

Description (P9.20 and P9.21):

P9.20: Each digital input corresponds to one bit (Bit0 = X1, Bit1 = X2 … Bit4 = X5). An input that is ON gives 1, an input that is OFF gives 0. The decimal value of this binary number is displayed.
P9.21: Each digital output corresponds to one bit (Bit0 = MOA-MOB-MOC, Bit1 = YA-YB-YC, Bit3 = YO). An output that is ON gives 1, an output that is OFF gives 0. The decimal value is displayed.

P9.47	**Fault protection action selection 1**		**Default**	**00000**
	Setting range	**Unit's digit**	**Motor overload (OL1)**	
		0	Coast to stop	
		1	Stop according to the stop mode	
		2	Continue to run	
		Ten's digit	**Reserved**	
		Hundred's digit	**Output phase loss (LO), same as unit's digit**	
		Thousand's digit	**External equipment fault (EF), same as unit's digit**	
		Ten thousand's digit	**Communication fault (CE), same as unit's digit**	

P9.48	**Fault protection action selection 2**		**Default**	**00000**
	Setting range	**Unit's digit**	**Reserved**	
		Ten's digit	**Function code read-write fault (EEP)**	
		0	Coast to stop	
		1	Stop according to the stop mode	
		Hundred's digit	**Reserved**	
		Thousand's digit	**Reserved**	
		Ten thousand's digit	**Accumulative running time reached (END1), same as unit's digit of P9.47**	

P9.49	**Fault protection action selection 3**		**Default**	**00000**
	Setting range	**Unit's digit**	**Reserved**	
		Ten's digit	**Reserved**	
		Hundred's digit	**Accumulative power-on time reached (END2), same as unit's digit of P9.47**	
		Thousand's digit	**Load becoming 0 (LOAD)**	
		0	Coast to stop	
		1	Stop according to the stop mode	
		2	Continue to run at 7% of rated motor frequency, resume to set frequency when the load recovers	
		Ten thousand's digit	**PID feedback lost during running (PIDE), same as unit's digit of P9.47**	

P9.50	**Fault protection action selection 4**		**Default**	**00000**
	Setting range	**Unit's digit**	**Speed deviation too large (ESP), same as unit's digit of P9.47**	
		Ten's digit	**Reserved**	
		Hundred's digit	**Reserved**	

Description (P9.47 to P9.50):

Coast to stop: The AC drive displays the fault code and stops the output immediately.
Stop according to the stop mode: The AC drive displays an alarm code and stops according to the stop mode. After stopping, it displays the fault code.
Continue to run: The AC drive continues to run and displays an alarm code. The running frequency is set in P9.54.

P9.54	**Frequency selection for continuing to run upon fault**		**Default**	**0**
	Setting range	**0**	Current running frequency	
		1	Set frequency	
		2	Frequency upper limit	
		3	Frequency lower limit	
		4	Backup frequency upon abnormality (P9.55)	

P9.55	**Backup frequency upon abnormality**		**Default**	**100.0%**
	Setting range	0.0%–100.0% (100.0% = maximum frequency P0.10)		

Description (P9.54 and P9.55):

If a fault occurs during running for which "Continue to run" is set, the AC drive displays an alarm code and continues to run at the frequency selected in P9.54. P9.55 is a percentage of the maximum frequency.

P9.56	**Motor temperature protection sensor selection**		**Default**	**0**
	Setting range	**0**	Inactive	
		1	PT100	
		2	PT1000	
		3	KTY84	
		4	PTC (1.5 K)	
		5	PTC (4 K)	
P9.57	**Motor over-temperature protection threshold**		**Default**	**110**
	Setting range	**0–200 °C**		
P9.58	**Motor over-temperature alarm threshold**		**Default**	**90**
	Setting range	**0–200 °C**		

Description (P9.56 to P9.58):

P9.56 selects the sensor for motor temperature protection.
P9.57 sets the motor temperature at which the motor over-temperature protection trips.
The alarm threshold P9.58 is used to send a warning signal to the control system via YO before the motor over-temperature fault protection is activated.
This warning temperature is used to determine how far in advance the warning should be issued before the motor over-temperature protection is activated. The higher the value, the shorter the advance warning time.

P9.59	**Action selection at instantaneous power failure**		**Default**	**0**
	Setting range	**0**	Inactive	
		1	Decelerate	
		2	Decelerate to stop	

P9.60	**Action pause judging voltage at instantaneous power failure**	**Default**	**85%**
	Setting range	80%–100%	
P9.61	**Voltage recovery judging time at instantaneous power failure**	**Default**	**0.5 s**
	Setting range	0.0 s–100.0 s	
P9.62	**Action judging voltage at instantaneous power failure**	**Default**	**80.0%**
	Setting range	60.0%–100.0% (standard DC bus voltage)	

Description (P9.59 to P9.62):

Upon instantaneous power failure or sudden voltage dip, the DC bus voltage of the AC drive drops. With this function, the AC drive compensates the voltage drop with the energy fed back by the load by reducing the output frequency, so that it can keep running.
P9.59 = 1: Upon power failure or voltage dip, the AC drive decelerates. When the DC bus voltage is normal again, it accelerates to the set frequency. The voltage is considered normal when it stays in the normal range for longer than P9.61.
P9.59 = 2: Upon power failure or voltage dip, the AC drive decelerates to stop.
Figure 6.24 shows the sequence.

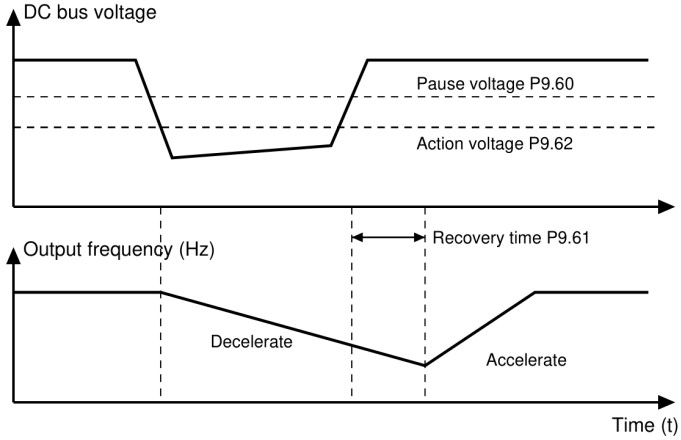


Figure 6.24 - AC drive action upon instantaneous power failure

P9.71	**Instantaneous power failure gain**	**Default**	**40**
	Setting range	0–100	
P9.72	**Instantaneous power failure integral coefficient**	**Default**	**30**
	Setting range	0–100	
P9.73	**Instantaneous power failure action deceleration time**	**Default**	**20.0 s**
	Setting range	0.0 s–300.0 s	

Description (P9.71 to P9.73):

Controller parameters and deceleration time for the action at instantaneous power failure (P9.59).

P9.63	**Protection upon load becoming 0**		**Default**	**0**
	Setting range	**0**	Disabled	
		1	Enabled	

P9.64	**Detection level of load becoming 0**	**Default**	**10.0%**
	Setting range	0.0%–100.0% (rated motor current)	
P9.65	**Detection time of load becoming 0**	**Default**	**1.0 s**
	Setting range	0.0 s–60.0 s	

Description (P9.63 to P9.65):

If the protection is enabled and the output current stays below the detection level (P9.64) for longer than the detection time (P9.65), the AC drive automatically reduces the output frequency to 7% of the rated frequency. When the load returns to normal, it automatically accelerates to the set frequency again.

P9.67	**Overspeed detection value**	**Default**	**20.0%**
	Setting range	0.0%–50.0% (maximum frequency P0.10)	
P9.68	**Overspeed detection time**	**Default**	**1.0 s**
	Setting range	0.0 s–60.0 s	

Description (P9.67 and P9.68):

Valid only for closed-loop vector control (CLV). If the actual motor speed exceeds the set frequency by more than P9.67 for longer than P9.68, the AC drive reports OSP and acts according to the selected fault protection action.

P9.69	**Detection value of speed deviation too large**	**Default**	**20.0%**
	Setting range	0.0%–50.0% (maximum frequency P0.10)	
P9.70	**Detection time of speed deviation too large**	**Default**	**5.0 s**
	Setting range	0.0 s–60.0 s	

Description (P9.69 and P9.70):

Valid only for closed-loop vector control (CLV). If the deviation between the actual motor speed and the set frequency is greater than P9.69 for longer than P9.70, the AC drive reports ESP and acts according to the selected fault protection action (P9.50). With P9.70 = 0.0 s, the function is disabled.

6.11 Group PA: PID Function

PID control is a general process control method. Proportional, integral and differential operations are performed on the difference between the feedback signal and the setting. The AC drive adjusts its output frequency accordingly and forms a closed loop that keeps the controlled variable at the setting.
Typical applications are flow, pressure and temperature control. Figure 6.25 shows the principle.

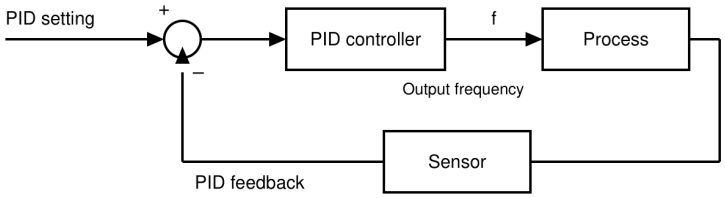


Figure 6.25 - Principle of PID control

PA.00	**PID setting source**		**Default**	**0**
	Setting range	**0**	Digital setting (PA.01)	
		1	FIV	
		2	FIC	
		3	Reserved	
		4	PULSE setting	
		5	Communication setting	
		6	Multi-reference	

PA.01	**PID digital setting**		**Default**	**50.0%**
	Setting range	0.0%–100.0%		

Description (PA.00 and PA.01):

PA.00 selects the source of the PID setting. Setting and feedback are relative values from 0.0% to 100.0%. The purpose of PID control is to make setting and feedback equal.

PA.02	**PID feedback source**		**Default**	**0**
	Setting range	**0**	FIV	
		1	FIC	
		2	Reserved	
		3	FIV – FIC	
		4	PULSE setting	
		5	Communication setting	
		6	FIV + FIC	
		7	MAX (|FIV|, |FIC|)	
		8	MIN (|FIV|, |FIC|)	

Description:

Selects the source of the PID feedback signal. The feedback is a relative value from 0.0% to 100.0%.

PA.03	**PID action direction**		**Default**	**0**
	Setting range	**0**	Forward action	
		1	Reverse action	

Description:

Forward action (0): If the feedback is smaller than the setting, the output frequency rises. Example: winding tension control.
Reverse action (1): If the feedback is smaller than the setting, the output frequency falls. Example: unwinding tension control.
The action direction can additionally be reversed via a digital input with function 35 (PID action direction reverse). Pay attention to this in the application.

PA.04	**PID setting feedback range**		**Default**	**1000**
	Setting range	0–65535		

Description:

Non-dimensional value for the display of the PID setting (d0.15) and PID feedback (d0.16). 100% of the PID setting corresponds to the value of PA.04. Example: with PA.04 = 2000 and a PID setting of 100.0%, d0.15 shows 2000.

PA.05	**Proportional gain Kp1**		**Default**	**20.0**
	Setting range	0.0–100.0		
PA.06	**Integral time Ti1**		**Default**	**2.00 s**
	Setting range	0.01 s–10.00 s		
PA.07	**Differential time Td1**		**Default**	**0.000 s**
	Setting range	0.000 s–10.000 s		

Description (PA.05 to PA.07):

Proportional gain Kp1 (PA.05): Determines the regulating intensity of the PID controller. The higher Kp1, the stronger the regulation. The value 100.0 means: with a deviation of 100.0% between feedback and setting, the controller adjusts the frequency reference by the maximum frequency.
Integral time Ti1 (PA.06): Determines the integral regulating intensity. The shorter the integral time, the stronger the regulation. With a deviation of 100.0%, the adjustment by the integral part reaches the maximum frequency after the time PA.06.
Differential time Td1 (PA.07): Determines how strongly the controller responds to changes of the deviation. The longer the differential time, the stronger the response. If the feedback changes by 100.0% within this time, the adjustment reaches the maximum frequency.

PA.08	**Cut-off frequency of PID reverse rotation**		**Default**	**2.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)		

Description:

In some cases, setting and feedback can only be made equal if the PID output frequency is negative, i.e. the AC drive runs in reverse. As a too high reverse frequency is often not permitted, PA.08 limits the frequency in reverse rotation.

PA.09	**PID deviation limit**		**Default**	**0.0%**
	Setting range	0.0%–100.0%		
PA.10	**PID differential limit**		**Default**	**0.10%**
	Setting range	0.00%–100.00%		
PA.11	**PID setting change time**		**Default**	**0.00 s**
	Setting range	0.00 s–650.00 s		

Description (PA.09 to PA.11):

PA.09: If the deviation between feedback and setting is smaller than PA.09, PID control stops. A small deviation keeps the output frequency stable, which is advantageous in some closed-loop applications.
PA.10: Limits the output of the differential part. The differential operation may easily cause oscillation and is therefore restricted to a small range.
PA.11: Time in which the PID setting changes from 0.0% to 100.0%. The setting changes linearly, reducing the impact of sudden setting changes on the system.

PA.12	**PID feedback filter time**		**Default**	**0.00 s**
	Setting range	0.00 s–60.00 s		
PA.13	**PID output filter time**		**Default**	**0.00 s**
	Setting range	0.00 s–60.00 s		

Description (PA.12 and PA.13):

PA.12 filters the PID feedback, reducing interference but slowing down the response of the closed loop.
PA.13 filters the PID output frequency, smoothing sudden changes of the output frequency but also slowing down the response of the closed loop.

PA.15	**Proportional gain Kp2**		**Default**	**20.0**
	Setting range	0.0–100.0		
PA.16	**Integral time Ti2**		**Default**	**2.00 s**
	Setting range	0.01 s–10.00 s		
PA.17	**Differential time Td2**		**Default**	**0.000 s**
	Setting range	0.000 s–10.000 s		

PA.18	**PID parameter switchover condition**		**Default**	**0**
	Setting range	**0**	No switchover	
		1	Switchover via digital input	
		2	Automatic switchover based on deviation	
		3	Automatic switchover based on running frequency	

PA.19	**PID parameter switchover deviation 1**		**Default**	**20.0%**
	Setting range	0.0% to PA.20		
PA.20	**PID parameter switchover deviation 2**		**Default**	**80.0%**
	Setting range	PA.19 to 100.0%		

Description (PA.15 to PA.20):

If one group of PID parameters is not sufficient for the whole running process, you can switch over between two groups. PA.15 to PA.17 are set in the same way as PA.05 to PA.07.
Switchover via digital input (1): A digital input must be assigned function 43 (PID parameter switchover). If the input is OFF, group 1 (PA.05 to PA.07) applies; if it is ON, group 2 (PA.15 to PA.17) applies.
Automatic switchover based on deviation (2): If the absolute deviation is smaller than PA.19, group 1 applies; if it is larger than PA.20, group 2 applies. In between, the parameters are linearly interpolated between both groups (see Figure 6.26).

Automatic switchover based on running frequency (3): The switchover depends on the running frequency.

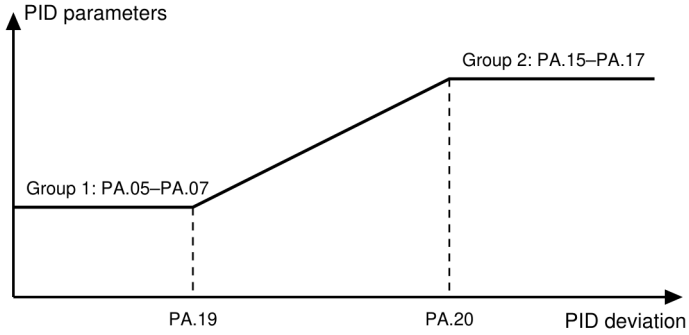


Figure 6.26 - PID parameter switchover

PA.21	**PID initial value**	**Default**	**0.0%**
	Setting range	0.0%–100.0%	
PA.22	**PID initial value holding time**	**Default**	**0.00 s**
	Setting range	0.00 s–650.00 s	

Description (PA.21 and PA.22):

At startup, the PID output is first fixed to the initial value PA.21 and held for the time PA.22. Only then does the closed-loop control start (see Figure 6.27).

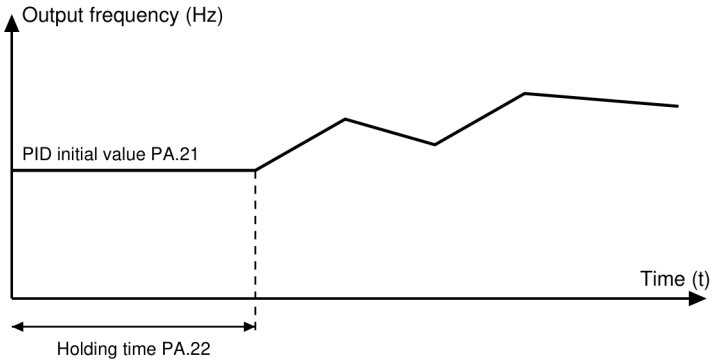


Figure 6.27 - PID initial value

PA.25	**PID integral property**		**Default**	**00**
	Setting range	**Unit's digit**	**Integral separation**	
		0	Disabled	
		1	Enabled	
		Ten's digit	**Integral operation when the output reaches the limit**	
		0	Continue integral operation	
		1	Stop integral operation	

Description:

Integral separation: If enabled, the integral operation stops while a digital input with function 38 (PID integral pause) is active. Only the proportional and differential parts are then effective. If disabled, this input has no effect.
Integral operation when the output reaches the limit: If "Stop integral operation" is selected, the integral operation stops as soon as the PID output reaches its limit. This can reduce PID overshoot.

PA.26	**Detection value of PID feedback loss**	**Default**	**0.0%**
	Setting range	0.0% (no detection), 0.1%–100.0%	
PA.27	**Detection time of PID feedback loss**	**Default**	**0.0 s**
	Setting range	0.0 s–20.0 s	

Description (PA.26 and PA.27):

If the PID feedback is smaller than PA.26 for longer than PA.27, the AC drive reports PIDE and acts according to the selected fault protection action (P9.49, ten thousand's digit).

PA.28	**PID operation at stop**		**Default**	**0**
	Setting range	**0**	No PID operation at stop	
		1	PID operation at stop	

Description:

Sets whether the PID operation continues at stop. Normally, the PID operation stops when the AC drive stops.

6.12 Group PC: Multi-Reference Speed and Simple PLC Functions

Besides multi-speed, the multi-references can also be used as the voltage source for V/F separation and as the setting source of process PID. They are relative values.
The simple PLC can only perform simple sequences of multi-references.

PC.00	**Multi-reference 0**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.01	**Multi-reference 1**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.02	**Multi-reference 2**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.03	**Multi-reference 3**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.04	**Multi-reference 4**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.05	**Multi-reference 5**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.06	**Multi-reference 6**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.07	**Multi-reference 7**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.08	**Multi-reference 8**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.09	**Multi-reference 9**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.10	**Multi-reference 10**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.11	**Multi-reference 11**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.12	**Multi-reference 12**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.13	**Multi-reference 13**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.14	**Multi-reference 14**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		
PC.15	**Multi-reference 15**		**Default**	**0.0%**
	Setting range	-100.0% to +100.0%		

Description (PC.00 to PC.15):

The multi-references are relative values from -100.0% to 100.0%. As frequency source, they refer to the maximum frequency; as V/F separation voltage source, to the rated motor voltage. As PID setting source, no conversion is required.
The multi-references are selected via the states of the digital inputs with functions 12 to 15 (see group P4).

PC.16	**Simple PLC running mode**		**Default**	**0**
	Setting range	**0**	Stop after one cycle	
		1	Keep final values after one cycle	
		2	Repeat after one cycle	

Description:

The simple PLC can be used as frequency source or as voltage source for V/F separation. As frequency source, the sign of PC.00 to PC.15 determines the running direction: negative values mean reverse rotation (see Figure 6.28). After each completed cycle, a digital output with function 11 (PLC cycle complete) outputs a 250 ms pulse.
The three running modes apply only when the PLC is used as frequency source:
Stop after one cycle (0): The AC drive stops after one cycle and starts again only upon a new running command.
Keep final values (1): After one cycle, the AC drive keeps the final running frequency and direction.

Repeat (2): After one cycle, the next cycle starts automatically until a stop command is given.

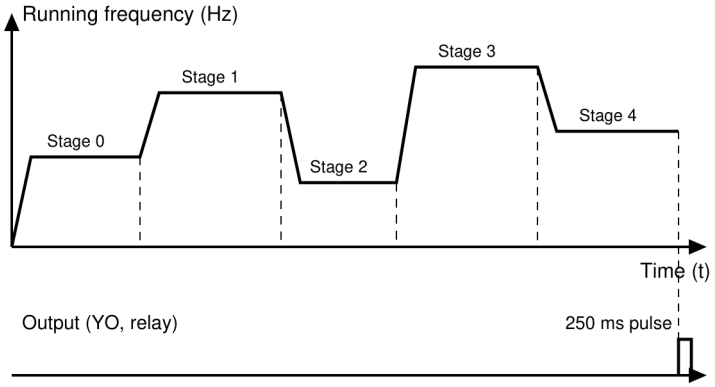


Figure 6.28 - Simple PLC used as frequency source

PC.17	**Simple PLC retentive selection**		**Default**	**00**
	Setting range	**Unit's digit**	**Retentive upon power failure**	
		0	No	
		1	Yes	
		Ten's digit	**Retentive upon stop**	
		0	No	
		1	Yes	

Description:

Retentive upon power failure: The AC drive memorizes the PLC running moment and frequency before power failure and continues from there after power-on. With unit's digit = 0, the PLC restarts from the beginning after power-on.

Retentive upon stop: The AC drive records the PLC running moment and frequency at stop and continues from there at the next start. With ten's digit = 0, the PLC restarts from the beginning at start.

PC.18	**Running time of simple PLC reference 0**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.19	**Acc./dec. time of simple PLC reference 0**		**Default**	**0**
	Setting range	0–3		
PC.20	**Running time of simple PLC reference 1**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.21	**Acc./dec. time of simple PLC reference 1**		**Default**	**0**
	Setting range	0–3		
PC.22	**Running time of simple PLC reference 2**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.23	**Acc./dec. time of simple PLC reference 2**		**Default**	**0**
	Setting range	0–3		
PC.24	**Running time of simple PLC reference 3**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.25	**Acc./dec. time of simple PLC reference 3**		**Default**	**0**
	Setting range	0–3		

PC.26	**Running time of simple PLC reference 4**	**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)	
PC.27	**Acc./dec. time of simple PLC reference 4**	**Default**	**0**
	Setting range	0–3	
PC.28	**Running time of simple PLC reference 5**	**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)	
PC.29	**Acc./dec. time of simple PLC reference 5**	**Default**	**0**
	Setting range	0–3	
PC.30	**Running time of simple PLC reference 6**	**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)	
PC.31	**Acc./dec. time of simple PLC reference 6**	**Default**	**0**
	Setting range	0–3	
PC.32	**Running time of simple PLC reference 7**	**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)	
PC.33	**Acc./dec. time of simple PLC reference 7**	**Default**	**0**
	Setting range	0–3	
PC.34	**Running time of simple PLC reference 8**	**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)	
PC.35	**Acc./dec. time of simple PLC reference 8**	**Default**	**0**
	Setting range	0–3	
PC.36	**Running time of simple PLC reference 9**	**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)	
PC.37	**Acc./dec. time of simple PLC reference 9**	**Default**	**0**
	Setting range	0–3	
PC.38	**Running time of simple PLC reference 10**	**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)	

PC.39	**Acc./dec. time of simple PLC reference 10**		**Default**	**0**
	Setting range	0–3		
PC.40	**Running time of simple PLC reference 11**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.41	**Acc./dec. time of simple PLC reference 11**		**Default**	**0**
	Setting range	0–3		
PC.42	**Running time of simple PLC reference 12**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.43	**Acc./dec. time of simple PLC reference 12**		**Default**	**0**
	Setting range	0–3		
PC.44	**Running time of simple PLC reference 13**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.45	**Acc./dec. time of simple PLC reference 13**		**Default**	**0**
	Setting range	0–3		
PC.46	**Running time of simple PLC reference 14**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.47	**Acc./dec. time of simple PLC reference 14**		**Default**	**0**
	Setting range	0–3		
PC.48	**Running time of simple PLC reference 15**		**Default**	**0.0 s (h)**
	Setting range	0.0 s (h)–6500.0 s (h)		
PC.49	**Acc./dec. time of simple PLC reference 15**		**Default**	**0**
	Setting range	0–3		

Description (PC.18 to PC.49):

For each of the 16 stages of the simple PLC, the running time and the acceleration/deceleration time are set. The values 0 to 3 select acceleration/deceleration times 1 to 4 (P0.17/P0.18, P8.03 to P8.08). The time unit is set in PC.50.

PC.50	Time unit of simple PLC running		Default	0
	Setting range	0	s (second)	
		1	h (hour)	

PC.51	Reference 0 source		Default	0
	Setting range	0	Set by PC.00	
		1	FIV	
		2	FIC	
		3	Reserved	
		4	PULSE setting	
		5	PID	
		6	Preset frequency (P0.08), modified via UP/DOWN	

Description:

Determines the setting channel of reference 0. This allows convenient switchover between setting channels when the multi-references or the simple PLC are used as frequency source.

6.13 Group PD: Communication Parameters

This group sets the parameters of the serial communication. For details of the protocol, refer to the VCD100 communication protocol.

PD.00	**Baud rate selection**		**Default**	**5005**
	Setting range	**Unit's digit**	**MODBUS**	
		0	300 bps	
		1	600 bps	
		2	1200 bps	
		3	2400 bps	
		4	4800 bps	
		5	9600 bps	
		6	19200 bps	
		7	38400 bps	
		8	57600 bps	
		9	115200 bps	
		Ten's digit	**Reserved**	
		Hundred's digit	**Reserved**	
		Thousand's digit	**CANopen**	
		0	20 kbps	
		1	50 kbps	
		2	100 kbps	
		3	125 kbps	
		4	250 kbps	
		5	500 kbps	
		6	1 Mbps	

PD.01	**Data format**		**Default**	**3**
	Setting range	**0**	No parity (8-N-2)	
		1	Even parity (8-E-1)	
		2	Odd parity (8-O-1)	
		3	No parity (8-N-1)	

PD.02	**Local communication address**		**Default**	**1**
	Setting range	1–247		
PD.03	**Response delay**		**Default**	**2 ms**
	Setting range	0 ms–20 ms		
PD.04	**Communication timeout**		**Default**	**0.0 s**
	Setting range	0.0 s (disabled), 0.1 s–60.0 s		

PD.05	**Data transfer format selection**		**Default**	**1**
	Setting range	**Unit's digit**	**MODBUS**	
		0	Non-standard MODBUS protocol	
		1	Standard MODBUS protocol	
		Ten's digit	**Reserved**	

PD.06	**Communication reading current resolution**		**Default**	**0**
	Setting range	**0**	0.01 A	
		1	0.1 A	

Description (PD.00 to PD.06):

PD.00 sets the baud rate for MODBUS (unit's digit) and CANopen (thousand's digit). The factory setting 5005 corresponds to 9600 bps (MODBUS) and 500 kbps (CANopen). PD.01 sets the data format. Baud rate and data format must be the same for all devices.
PD.02 is the address of the AC drive in the network. Each address may only be assigned once.
PD.03 sets the waiting time between receiving a request and sending the response.
PD.04: If the AC drive receives no valid message within this time, it reports a communication fault (CE). With 0.0 s, the monitoring is disabled.
PD.05 selects between the standard and a non-standard MODBUS protocol. PD.06 sets the resolution with which the output current is read via communication.

6.14 Group PP: User-Defined Function Codes

PP.00	**User password**		**Default**	**0**
	Setting range	0–65535		

Description:

If it is set to any non-zero number, password protection is enabled. You must then enter the correct password to enter the menu. If the password is incorrect, you cannot view or modify parameters. With PP.00 = 00000, the password is cleared and password protection is disabled.

PP.01	**Restore default settings**		**Default**	**0**
	Setting range	**0**	No operation	
		1	Restore factory settings except motor parameters	

Description:

With PP.01 = 1, most parameters are restored to the factory settings. Excepted are the motor parameters, the fault records, the accumulative running time (P7.09), the accumulative power-on time (P7.13) and the accumulative power consumption (P7.14).

6.15 Group C0: Torque Control and Restricting Parameters

C0.00	**Speed/torque control selection**		**Default**	**0**
	Setting range	**0**	Speed control	
		1	Torque control	

Description:

Selects speed control or torque control. In addition, there are two digital input functions: 29 (torque control prohibited) and 46 (speed control/torque control switchover).
If the input with function 46 is OFF, the setting of C0.00 applies. If it is ON, the other control mode applies. If the input with function 29 is ON, the AC drive always runs in speed control.

C0.01	**Torque setting source in torque control**		**Default**	**0**
	Setting range	**0**	Digital setting (C0.03)	
		1	FIV	
		2	FIC	
		3	Reserved	
		4	PULSE setting	
		5	Communication setting	
		6	MIN (FIV, FIC)	
		7	MAX (FIV, FIC)	

C0.03	**Torque digital setting in torque control**		**Default**	**150.0%**
	Setting range	-200.0% to +200.0%		

Description (C0.01 and C0.03):

C0.01 sets the torque setting source. The torque setting is a relative value: 100.0% corresponds to the AC drive's rated torque. The range -200.0% to 200.0% means that the maximum torque is twice the AC drive's rated torque.
For sources 1 to 7, full scale (100%) corresponds to the value of C0.03.

C0.05	**Forward maximum frequency in torque control**		**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)		
C0.06	**Reverse maximum frequency in torque control**		**Default**	**50.00 Hz**
	Setting range	0.00 Hz to maximum frequency (P0.10)		

Description (C0.05 and C0.06):

Set the maximum frequency in forward and reverse rotation in torque control.
In torque control, if the load torque is smaller than the motor torque, the motor speed rises continuously. To avoid runaway of the mechanical system, the speed must be limited in torque control.

C0.07	**Acceleration time in torque control**	**Default**	**0.00 s**
	Setting range	0.00 s–650.00 s	
C0.08	**Deceleration time in torque control**	**Default**	**0.00 s**
	Setting range	0.00 s–650.00 s	

Description (C0.07 and C0.08):

In torque control, the difference between motor torque and load torque determines how fast the speed changes. Rapid speed changes may cause noise or high mechanical stress. These ramp times make the speed change smoothly.
In applications requiring rapid torque response, set both times to 0.00 s. Example: Two AC drives drive the same load. One runs as master in speed control, the other as slave in torque control with the master torque as setting.
The slave must follow the master quickly, so its times are set to 0.00 s.

6.16 Group C5: Control Optimization Parameters

C5.00	DPWM switchover frequency upper limit		Default	8.00 Hz
	Setting range	5.00 Hz to maximum frequency (P0.10)		

Description:

Valid only for V/F control of asynchronous motors. Below this frequency, 7-segment continuous modulation is used; above it, 5-segment intermittent modulation.
The 7-segment modulation causes higher switching losses but smaller current ripple. The 5-segment modulation causes lower switching losses but larger current ripple, which may lead to unstable motor running at high frequency. Generally, this parameter does not need to be modified.

C5.01	PWM modulation mode		Default	0
	Setting range	0	Asynchronous modulation	
		1	Synchronous modulation	

Description:

Valid only for V/F control. At high output frequencies (above 100 Hz), synchronous modulation improves the quality of the output voltage.

C5.02	Dead-zone compensation mode selection		Default	1
	Setting range	0	No compensation	
		1	Compensation mode 1	

Description:

Generally, this parameter does not need to be modified.

C5.03	Random PWM depth		Default	0
	Setting range	0	Random PWM inactive	
		1–10	PWM carrier frequency random depth	

Description:

Random PWM reduces motor noise and electromagnetic interference.

C5.04	Fast current limitation		Default	1
	Setting range	0	Disabled	
		1	Enabled	

Description:

Fast current limitation reduces overcurrent faults so that the AC drive can continue to work normally. If it is active for a long time, the AC drive may overheat and reports the fault CBC (fast current limit timeout). The AC drive must then be stopped.

C5.05	Voltage overmodulation coefficient		Default	105
	Setting range	100–110		

Description:

Sets the overmodulation coefficient of the output voltage. Modification is not recommended.

C5.06	Undervoltage threshold setting		Default	Model dependent
	Setting range	200.0 V–2000.0 V		

Description:

Sets the voltage at which the AC drive reports the undervoltage fault. The factory setting depends on the voltage class of the drive.

C5.07	SVC optimization mode selection		Default	1
	Setting range	**0**	No optimization	
		1	Optimization mode 1	
		2	Optimization mode 2	

Description:

Valid only for sensorless vector control (SVC).
Optimization mode 1 (1): used when the requirement on torque control linearity is high.
Optimization mode 2 (2): used when the requirement on speed stability is high.

C5.08	Dead-zone time adjustment		Default	150%
	Setting range	100%–200%		

Description:

Adjusting this value improves the voltage utilization. A too small value may cause unstable operation. Modification is not recommended.

C5.09	Overvoltage threshold setting		Default	Model dependent
	Setting range	200.0 V–2200.0 V		

Description:

Sets the voltage at which the AC drive reports the overvoltage fault. Factory setting: 400 V for single- or three-phase 220 V drives, 810 V for three-phase 380 V drives.

6.17 Group d0: Monitoring Parameters

Group d0 is used to monitor the AC drive's running state. The values can be viewed on the operation panel or read by a host computer via communication, e.g. during commissioning. d0.00 to d0.31 are the display values in the running and stop state selected with P7.03, P7.04 and P7.05.

Function Code	Parameter Name	Resolution	Unit
d0.00	Running frequency	0.01	Hz
d0.01	Set frequency	0.01	Hz
d0.02	DC bus voltage	0.1	V
d0.03	Output voltage	1	V
d0.04	Output current	0.01	A
d0.05	Output power	0.1	kW
d0.06	Output torque	0.1	%
d0.07	DI input status	1	—
d0.08	DO output status	1	—
d0.09	FIV voltage	0.01	V
d0.10	FIC voltage	0.01	V
d0.11	Reserved	—	—
d0.12	Count value	1	—
d0.13	Length value	1	—
d0.14	Load speed display	1	—
d0.15	PID setting	1	—
d0.16	PID feedback	1	—
d0.17	PLC stage	1	—
d0.18	Input pulse frequency	0.01	kHz
d0.19	Motor speed	1	rpm
d0.20	Remaining running time	0.1	min

Function Code	Parameter Name	Resolution	Unit
d0.21	FIV voltage before correction	0.001	V
d0.22	FIC voltage before correction	0.001	V
d0.23	Reserved	—	—
d0.24	Linear speed	1	m/min
d0.25	Current power-on time	1	min
d0.26	Current running time	0.1	min
d0.27	Input pulse frequency	1	Hz
d0.28	Communication setting	0.01	%
d0.29	Encoder feedback frequency	0.01	Hz
d0.30	Main frequency X display	0.01	Hz
d0.31	Auxiliary frequency Y display	0.01	Hz
d0.32	View any memory address values	1	—
d0.33	Reserved	—	—
d0.34	Motor temperature value	1	°C
d0.35	Target torque	0.1	%
d0.36	Resolver position	1	—
d0.37	Power factor angle	0.1	°
d0.38	ABZ position	1	—
d0.39	Target voltage upon V/F separation	1	V
d0.40	Output voltage upon V/F separation	1	V
d0.41	Reserved	—	—
d0.42	Reserved	—	—
d0.43	Reserved	—	—
d0.44	Reserved	—	—

Function Code	Parameter Name	Resolution	Unit
d0.45	Fault information	1	—
d0.58	Z signal counter	1	—
d0.59	Setting frequency percentage	0.01	%
d0.60	Running frequency percentage	0.01	%
d0.61	AC drive state	1	—
d0.74	AC drive output torque	0.1	%

7. STO - Safe Torque Off Features

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7.1 Definition

- **STO safety function (IEC 61800-5-2):** The STO safety function (Safe Torque Off) safely shuts off the motor torque without disconnecting the main power supply voltage. It does not monitor whether the motor has actually stopped rotating.
- **Stop Category 0 (IEC 60204-1):** This implies immediately shutting off the electrical energy supplied to the motor, causing the machine to coast to a stop (uncontrolled stop).

7.2 Functions

The safety function integrated into the product enables an "Emergency Stop" (IEC 60204-1) in accordance with Stop Category 0.

Working Principle:
The STO safety function is triggered by two independent hardware input terminals, STO1 and STO2, to cut off the machine's output torque. These two input terminals are wired separately to achieve true dual-channel characteristics. Both input terminals, STO1 and STO2, must be switched simultaneously to cut off the inverter output stage and trigger a fault message. The motor can no longer generate torque and will coast to a stop. It can only be restarted by performing a "Fault Reset" after both STO1 and STO2 are re-connected to the 24V / SGND control power.

7.3 Requirements for the Use of Safety Features

- **Shutdown Type:** This safety stop function complies with Stop Category 0, where the drive unit stops uncontrollably. If a hazard exists while approaching the coasting machine, appropriate secondary protective measures must be implemented.
- **Vertical Axes and External Forces:** When an external force (such as gravity) that could cause dangerous or unexpected movement is applied to the drive unit (e.g., vertical axes), the drive unit must not be operated without the necessary mechanical fall protection measures in place.
- **Prevention of Accidental Restart:** To prevent the motor from restarting automatically, ensure that there is no 24V / SGND input signal applied to STO1 and STO2 during maintenance or interventions.
- **Protection Level and Environment:** Ensure that there are no conductive contaminants present in the operating environment (Pollution Degree 2). Conductive contamination may cause the internal safety functions to fail.
- **Protective Cabling:** If a safety-related signal line is susceptible to short circuits or lateral cross-circuits that cannot be recognized by connected devices, protective cabling must be used in accordance with the ISO 13849-2 Default.
- **Note:** If protective wiring is not used, the two signal lines (channels) of the safety function might be connected to an external voltage due to cable damage, causing the safety function to fail completely.
- **Hazard and Risk Analysis:** Equipment manufacturers must conduct a comprehensive hazard and risk analysis of the entire system and take these analysis results into account when implementing the safety features.

7.4 Introduction to STO Principle Implementation

The system controls the PWM drive signal of the motor by monitoring the input signals STO1 and STO2 as well as the DSP level status, thereby achieving a safe motor stop.
When the STO terminal is connected to 24V, an enable level is provided. This enable level, together with the enable level issued by the DSP, affects the PWM signal driving the motor. The PWM drive can only function normally and the motor can only run when both the STO and DSP enable levels are valid. If either the STO or DSP enable level is invalid, the motor will stop. STO1 and STO2 are valid when both are connected to 24V, allowing motor output. When any one or both channels of STO1 and STO2 are simultaneously disconnected from 24V, both STO functions are invalid, and the motor will stop running regardless of the DSP enable signal.



Note:
The STO function is an operating mode that provides safety assurance during the transition from the fault response phase to the safe state. When performing an emergency shutdown, please disconnect both STO1 and STO2 signals simultaneously to ensure absolute safety.

7.5 Pin Description

Pin Name	Function Definition
STO1	STO1 safety input, dual-channel connection
STO2	STO2 safety input, dual-channel connection
24V	24V control system power supply
SGND	24V control system power supply reference potential, STO reference potential

7.6 Logical Explanation

STO1	STO2	Description
0V	**0V**	The motor is not running. Safe state reached.
0V	**24V**	The motor is not running. Channel asymmetry fault.
24V	**0V**	The motor is not running. Channel asymmetry fault.
24V	**24V**	The motor is operational. Normal running state.

8. Troubleshooting and Fault Countermeasures

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8.1 Fault Alarms and Countermeasures

The Velron VCD100 AC drive features a comprehensive range of warning functions and protection mechanisms. In the event of a fault, the protective function is activated immediately, the drive terminates its output, and the fault relay contact is triggered while the corresponding fault code is displayed on the operating panel.

Users can perform a preliminary check based on the displayed troubleshooting tips before seeking professional service, analyzing the root cause of the problem to find an appropriate solution. If the cause of the failure points to an issue explicitly marked within the manufacturer service indicators, please contact your local Velron distribution agent or contact our technical support team directly.

The hardware warning message **OUOC** indicates an overcurrent or overvoltage condition at the hardware level. In most practical applications, a hardware-level overvoltage fault is the primary trigger for the **OUOC** alarm.

Fault Name	Display	Possible Causes	Solutions
Inverter unit protection	**OC**	1: Output circuit is short-circuited. 2: Connecting cable of the motor is too long. 3: Power module overheats. 4: Internal connections are loose. 5: Main control board is faulty. 6: Drive board is faulty. 7: Inverter IGBT module is faulty.	1: Check the motor/cable and eliminate external faults. 2: Install an output reactor or an output filter. 3: Check the air vents and the cooling fan. 4: Connect all cables and internal plugs properly. 5-7: Contact technical support.
Overcurrent during acceleration	**OC1**	1: Output circuit is grounded or short-circuited. 2: Control mode is vector control, but motor auto-tuning has not been performed. 3: Acceleration time is too short. 4: Manual torque boost or V/F curve is inappropriate. 5: Input voltage is too low. 6: Startup operation is performed on a rotating motor. 7: A sudden load is added during acceleration. 8: AC drive model power class is too small.	1: Check the motor/cable and eliminate external faults. 2: Perform the motor auto-tuning. 3: Increase the acceleration time. 4: Adjust the manual torque boost or V/F curve. 5: Adjust the voltage to the normal range. 6: Select rotational speed tracking restart or start the motor after it stops. 7: Remove the sudden load. 8: Select an AC drive of a higher power class.

Fault Name	Display	Possible Causes	Solutions
Overcurrent during deceleration	**OC2**	1: Output circuit is grounded or short-circuited. 2: Motor auto-tuning has not been performed. 3: Deceleration time is too short. 4: Input voltage is too low. 5: A sudden load is added during deceleration. 6: Braking unit and braking resistor are not installed.	1: Check the motor/cable and eliminate external faults. 2: Perform the motor auto-tuning. 3: Increase the deceleration time. 4: Adjust the voltage to the normal range. 5: Remove the sudden load. 6: Install a braking unit and a braking resistor.
Overcurrent at constant speed	**OC3**	1: Output circuit is grounded or short-circuited. 2: Motor auto-tuning has not been performed. 3: Input voltage is too low. 4: A sudden load is added during operation. 5: AC drive model power class is too small.	1: Check the motor/cable and eliminate external faults. 2: Perform the motor auto-tuning. 3: Adjust the voltage to the normal range. 4: Remove the sudden load. 5: Select an AC drive of a higher power class.
Overvoltage during acceleration	**OU1**	1: Input voltage is too high. 2: An external force drives the motor during acceleration. 3: Acceleration time is too short. 4: Braking unit and braking resistor are not installed.	1: Adjust the voltage to the normal range. 2: Cancel the external force or install a braking resistor. 3: Increase the acceleration time. 4: Install a braking unit and a braking resistor.
Overvoltage during deceleration	**OU2**	1: Input voltage is too high. 2: An external force drives the motor during deceleration. 3: Deceleration time is too short. 4: Braking unit and braking resistor are not installed.	1: Adjust the voltage to the normal range. 2: Cancel the external force or install a braking resistor. 3: Increase the deceleration time. 4: Install a braking unit and a braking resistor.
Overvoltage at constant speed	**OU3**	1: Input voltage is too high. 2: An external force drives the motor during constant speed operation. 3: Braking unit and braking resistor are not installed.	1: Adjust the voltage to the normal range. 2: Cancel the external force or install a braking resistor. 3: Install a braking unit and a braking resistor.

Fault Name	Display	Possible Causes	Solutions
Control power supply fault	**POF**	Input voltage is not within the allowable range.	Adjust the input voltage to the allowable range.
Undervoltage (Lack of voltage)	**LU**	1: Instantaneous power loss occurs on the input power supply. 2: AC drive's input voltage is not within the allowable range. 3: DC bus voltage is abnormal. 4: Rectifier bridge or buffer resistor is abnormal. 5: Drive board is abnormal. 6: Main control board is abnormal.	1: Reset the fault. 2: Adjust the voltage to the normal range. 3-6: Contact technical support.
AC drive overload	**OL2**	1: Load is too heavy or a motor stall occurs. 2: AC drive model power class is too small.	1: Reduce the load and check the motor and mechanical condition. 2: Select an AC drive of a higher power class.
Motor overload	**OL1**	1: Motor overload protection gain (P9.01) is set improperly. 2: Load is too heavy or a motor stall occurs. 3: AC drive model power class is too small.	1: Set P9.01 correctly. 2: Reduce the load and check the motor and mechanical condition. 3: Select an AC drive of a higher power class.
Input phase loss	**LI**	1: Three-phase input power is abnormal. 2: Drive board is abnormal. 3: Lightning protection board is abnormal. 4: Main control board is abnormal.	1: Check the input wiring. 2-4: Contact technical support.
Output phase loss	**LO**	1: Cable connecting the AC drive and the motor is faulty. 2: AC drive's three-phase output is unbalanced when the motor is running. 3: Drive board is faulty. 4: Inverter module is faulty.	1: Check the motor cable and eliminate external faults. 2: Check whether the motor three-phase winding is normal. 3-4: Contact technical support.
Module overheat	**OH**	1: Ambient temperature is too high. 2: Air filter or cooling fins are blocked. 3: Cooling fan is damaged.	1: Lower the ambient temperature. 2: Clean the air filter and vents. 3: Replace the damaged cooling fan.

Fault Name	Display	Possible Causes	Solutions
Module overheat	**OH**	4: Thermistor (NTC) of the power module is damaged. 5: Inverter module is damaged.	4: Replace the damaged thermistor / power board. 5: Replace the inverter module (Contact technical support).
Motor overheat	**OH2**	1: Motor temperature has exceeded the motor temperature protection threshold (P9.57), e.g. due to overload, frequent starts or long operation at low speed without forced ventilation. 2: Motor cooling is insufficient (motor fan defective, cooling fins dirty, ambient temperature too high). 3: Motor temperature sensor (PTC, PT100, PT1000, KTY84) is not connected, the sensor cable is broken or the sensor is defective. 4: Sensor type set in P9.56 does not match the installed sensor, or P9.56 is activated although no sensor is connected.	1: Let the motor cool down, reduce the load and switching frequency. Check threshold P9.57 against the motor data sheet. 2: Check and clean the motor fan and cooling fins; install forced ventilation if necessary. 3: Check the sensor wiring at terminal PTC, measure the sensor resistance, replace a defective sensor. 4: Set P9.56 to the installed sensor type. Without a sensor, set P9.56 = 0 (inactive).
External equipment fault	**EF**	External fault signal is input via digital input terminal.	Eliminate the external fault and reset the operation.
Communication fault	**CE**	1: Host computer / PLC is in an abnormal state. 2: Communication cable is faulty or disconnected. 3: Communication parameters in group Pd are set improperly.	1: Check the operation and cabling of the host computer. 2: Check the communication wiring. 3: Set the communication parameters in group Pd properly.
Contactor fault	**RAY**	1: Drive board or internal power supply board is faulty. 2: Internal DC link contactor/bypass relay is faulty.	1: Replace the faulty drive board or power supply board. 2: Replace the faulty contactor / contact technical support.
Current detection fault	**IE**	1: Hall current sensor device is faulty. 2: Drive board is faulty.	1: Replace the faulty Hall device. 2: Replace the faulty drive board / contact technical support.

Fault Name	Display	Possible Causes	Solutions
Motor auto-tuning fault	**TE**	1: Motor parameters are not set according to the motor nameplate. 2: Motor auto-tuning operation times out.	1: Set the motor parameters in group P1 according to the nameplate properly. 2: Check the cable connecting the AC drive and the motor.
EEPROM read-write fault	**EEP**	Internal EEPROM memory chip is damaged.	Replace the main control board (Contact technical support).
AC drive hardware fault	**OUOC**	1: Hardware overvoltage exists. 2: Hardware overcurrent exists.	1: Handle based on overvoltage guidelines (see OU1–OU3). 2: Handle based on overcurrent guidelines (see OC1–OC3).
Short circuit to ground fault	**GND**	Motor winding or motor cable is short-circuited to ground.	Check and replace the faulty cable or motor.
Accumulative running time reached	**END1**	Accumulative running time reaches the threshold value set in P8.17.	Clear the record / reset through the parameter initialization function (PP.01).
Accumulative power-on time reached	**END2**	Accumulative power-on time reaches the threshold value set in P8.16.	Clear the record / reset through the parameter initialization function (PP.01).
Load becoming 0 (Load loss)	**LOAD**	AC drive running current is lower than the load loss detection level (P9.64).	Check if the load / mechanical transmission is disconnected or verify that P9.64 and P9.65 are set correctly.
PID feedback loss	**PIDE**	PID feedback value is lower than the feedback loss detection level (PA.26).	Check the PID feedback sensor signal or set PA.26 to a proper value.
Pulse-by-pulse current limit	**CBC**	1: Load is too heavy or a locked-rotor condition occurs on the motor. 2: AC drive model power class is too small.	1: Reduce the load and check the motor and mechanical condition. 2: Select an AC drive of a higher power class.
Speed deviation too large	**ESP**	1: Motor parameters have not been identified via auto-tuning. 2: Speed deviation thresholds P9.69 and P9.70 are set incorrectly.	1: Perform motor parameter identification (Auto-tuning P1.37). 2: Set P9.69 and P9.70 to appropriate values.
Motor overspeed	**OSP**	Motor parameters have not been identified via auto-tuning.	Perform motor parameter identification (Auto-tuning P1.37).

8.2 Common Faults and Solutions

You may encounter the following operational issues during the use of the Velron VCD100 AC drive. Please refer to the table below for a straightforward fault analysis and immediate troubleshooting guidelines to resolve these common drive issues.

No.	Common Fault	Possible Causes	Solutions
1	No display upon power-on	1: No input power supply or input voltage is too low. 2: Switching power supply on the drive board is faulty. 3: Rectifier bridge is damaged. 4: Control board or operating panel is faulty. 5: Internal cable between control board, drive board, and panel is broken.	1: Check the input power supply. 2: Check the DC bus voltage. 3-5: Contact technical support.
2	"2000" is displayed upon power-on	1: 1. Poor contact in the ribbon cable between drive board and control board. 2. Related components on the control board are damaged. 3. Motor or motor cable is short-circuited to ground. 4. Hall current sensor is faulty. 5. Input voltage to the AC drive is too low.	1: Check internal connections. 2-4: Contact technical support. 5: Adjust input voltage.
3	"GND" is displayed upon power-on	1: Motor winding or motor output cable is short-circuited to ground. 2: AC drive internal hardware is damaged.	1: Measure the insulation resistance of the motor and output cable with a megohmmeter. 2: Contact technical support.
4	Normal display upon power-on, but "2000" is displayed immediately after running, followed by a stop	1: Cooling fan is damaged or locked-rotor condition occurs. 2: External control terminal wiring is short-circuited.	1: Replace the damaged cooling fan. 2: Check the terminal wiring and eliminate external faults.
5	OH (module overheat) fault is reported frequently	1: Carrier frequency setting is too high. 2: Cooling fan is damaged or air filter/fins are blocked. 3: Internal components (thermistor/NTC) are damaged.	1: Reduce the carrier frequency via P0.15. 2: Replace the fan and clean the air filter/cooling fins. 3: Contact technical support.

No.	Common Fault	Possible Causes	Solutions
6	Motor does not rotate after the AC drive starts running	1: Faulty motor or disconnected motor cables. 2: Motor parameters in group P1 are set improperly. 3: Ribbon cable between drive board and control board has poor contact. 4: Drive board is faulty.	1: Ensure the cabling between AC drive and motor is normal. 2: Check and reset motor parameters (Perform auto-tuning). 3: Clear mechanical blockages or replace motor if damaged. 4: Contact technical support.
7	Digital input (X/S) terminals are disabled / non-functional	1: Input parameters are set incorrectly. 2: External control signal is incorrect or missing. 3: Jumper bar across OP and +24V is loose or missing. 4: Control board is faulty.	1: Check and reset terminal parameters in group P4. 2: Re-connect and verify external signal cables. 3: Re-confirm and tighten the jumper bar across OP and +24V. 4: Contact technical support.
8	*Reserved*	—	—
9	AC drive reports overcurrent (OC) and overvoltage (OU) frequently	1: Motor parameters are set improperly. 2: Acceleration or deceleration time is too short. 3: Load fluctuates violently during operation.	1: Reset motor parameters or re-perform motor auto-tuning. 2: Set appropriate acceleration/deceleration times. 3: Check the mechanical load or contact technical support.
10	RAY is reported upon power-on or during drive operation	1: Internal soft-start contactor/bypass relay does not pick up due to loose cabling. 2: Contactor/relay is faulty. 3: Internal 24V power supply for the contactor is faulty.	1: Check whether internal contactor cables are loose. 2-3: Replace faulty components or contact technical support.

9. Parameter List

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9.1 Parameter Protection and Menu Navigation

If parameter PP.00 is set to a non-zero value, parameter protection is enabled. You must enter the correct user password to access the menu.
To disable the password protection function, log in using the current password and set PP.00 to 0.
Parameter menus customized by the user are not protected by the password.
Group P and Group C represent the basic function parameters, while Group D contains the monitoring parameters.

9.2 Meaning of Parameter Symbols

The symbols used in the function code tables in column **Type** are defined as follows:

Symbol	Description
*	The parameter can be modified when the AC drive is in either the stopped or running state.
×	The parameter cannot be modified while the AC drive is running. The drive must be stopped to change this value.
●	The parameter is an actual measured value (read-only monitoring parameter) and cannot be modified.
■	The parameter is a factory parameter and can only be modified by the manufacturer.

9.3 Default Function Parameters

9.3.1 Group P0: Basic Functions

Function Code	Parameter Name	Setting Range	Default	Type
P0.00	G/P type display	1: G type (Constant torque load) 2: P type (Variable torque load, e.g., fans and pumps)	Model dependent	●
P0.01	Control mode selection	0: Sensorless vector control (SVC) 1: Closed loop vector control (CLV) 2: Voltage / Frequency control (V/F)	2	×
P0.02	Command source selection	0: Operation panel control (LED off) 1: Terminal control (LED on) 2: Communication control (LED flashing)	0	*

Function Code	Parameter Name	Setting Range	Default	Type
P0.03	Main frequency source X selection	0: Digital setting (P0.08 preset frequency, UP/DOWN modifiable, no memory at power-down) 1: Digital setting (P0.08 preset frequency, UP/DOWN modifiable, memory at power-down) 2: FIV 3: FIC 4: Keypad potentiometer 5: Pulse setting 6: Multi-step speed command 7: Simple PLC 8: PID control 9: Communication control	0	✖
P0.04	Auxiliary frequency source Y selection	Same as P0.03 (Main frequency source X selection)	0	✖
P0.05	Auxiliary frequency source Y range selection	0: Relative to the maximum frequency 1: Relative to the main frequency source X	0	*
P0.06	Auxiliary frequency source Y range	0%–150%	100%	*
P0.07	Frequency source superposition selection	**Unit's digit (Frequency source):** 0: Main frequency source X 1: X and Y operation (relationship determined by ten's digit) 2: Switchover between X and Y 3: Switchover between X and "X and Y operation" 4: Switchover between Y and "X and Y operation" **Ten's digit (X and Y operation):** 0: X + Y 1: X – Y 2: Maximum value of X and Y 3: Minimum value of X and Y	00	*
P0.08	Preset frequency	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	*
P0.09	Rotation direction	0: Same direction (Forward) 1: Reverse direction	0	*
P0.10	Maximum frequency	50.00 Hz–599.00 Hz	50.00 Hz	✖
P0.11	Upper limit frequency source	0: P0.12 digital setting 1: FIV 2: FIC 3: Reserved 4: PULSE setting 5: Communication setting	0	✖

Function Code	Parameter Name	Setting Range	Default	Type
P0.12	Upper limit frequency	Lower limit frequency (P0.14) to maximum frequency (P0.10)	50.00 Hz	*
P0.13	Upper limit frequency offset	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*
P0.14	Lower limit frequency	0.00 Hz to upper limit frequency (P0.12)	0.00 Hz	*
P0.15	Carrier frequency	0.5 kHz–16.0 kHz	Model dependent	*
P0.16	Carrier frequency adjustment with temperature	0: No 1: Yes	0	*
P0.17	Acceleration time 1	0.00 s–65000 s	Model dependent	*
P0.18	Deceleration time 1	0.00 s–65000 s	Model dependent	*
P0.19	Acceleration/Deceleration time unit	0: 1 s 1: 0.1 s 2: 0.01 s	1	✖
P0.21	Frequency offset of auxiliary frequency source for X and Y operation	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*
P0.22	Frequency command resolution	2: 0.01 Hz	2	✖
P0.23	Retentive of digital setting frequency upon power-down	0: Not retentive 1: Retentive	0	*
P0.25	Acceleration/Deceleration time base frequency	0: Maximum frequency (P0.10) 1: Set frequency 2: 100 Hz	0	✖
P0.26	Base frequency for UP/DOWN modification during running	0: Running frequency 1: Set frequency	0	✖

Function Code	Parameter Name	Setting Range	Default	Type
P0.27	Binding command source to frequency source	**Unit's digit (Binding keypad command to frequency source):** 0: No binding 1: Digital setting frequency 2: FIV 3: FIC 4: Reserved 5: Pulse setting 6: Multi-step speed reference 7: Simple PLC 8: PID control 9: Communication setting **Ten's digit:** Binding terminal command to frequency source (0–9, same as unit's digit) **Hundred's digit:** Binding communication command to frequency source (0–9, same as unit's digit) **Thousand's digit:** Reserved	0000	*

9.3.2 Group P1: Motor Parameters

Function Code	Parameter Name	Setting Range	Default	Type
P1.00	Motor type	0: Common asynchronous motor 1: Variable frequency asynchronous motor	0	✖
P1.01	Rated motor power	0.1 kW–450.0 kW	Model dependent	✖
P1.02	Rated motor voltage	1 V–2000 V	Model dependent	✖
P1.03	Rated motor current	0.01 A–655.35 A	Model dependent	✖
P1.04	Rated motor frequency	0.01 Hz to maximum frequency (P0.10)	Model dependent	✖
P1.05	Rated motor rotational speed	1 rpm–65535 rpm	Model dependent	✖
P1.06	Stator resistance (asynchronous motor)	0.001 Ω–65.535 Ω	Auto-tuning	✖
P1.07	Rotor resistance (asynchronous motor)	0.001 Ω–65.535 Ω	Auto-tuning	✖

Function Code	Parameter Name	Setting Range	Default	Type
P1.08	Leakage inductance (asynchronous motor)	0.01 mH–655.35 mH	Auto-tuning	✖
P1.09	Mutual inductance (asynchronous motor)	0.1 mH–6553.5 mH	Auto-tuning	✖
P1.10	No-load current (asynchronous motor)	0.01 A to P1.03	Auto-tuning	✖
P1.27	Encoder resolution	1–65535	1024	✖
P1.28	Encoder type	0: ABZ incremental encoder 2: Resolver	0	✖
P1.30	Phase sequence of ABZ incremental encoder	0: Forward 1: Reverse	0	✖
P1.31	Encoder angle offset	0.0°–359.9°	0.0°	✖
P1.34	Number of resolver pole pairs	1–65535	1	✖
P1.36	PG card speed feedback wire-break detection time	0.0: No action (disabled) 0.1 s–10.0 s	0.0	✖
P1.37	Auto-tuning selection	0: No operation 1: Static auto-tuning 2: Rotational auto-tuning 3: Complete static auto-tuning	0	✖

9.3.3 Group P2: Motor Vector Control Parameters

Function Code	Parameter Name	Setting Range	Default	Type
P2.00	Speed loop proportional gain 1	1–100	30	*
P2.01	Speed loop integral time 1	0.01 s–10.00 s	0.50 s	*
P2.02	Switchover frequency 1	0.00 Hz to P2.05	5.00 Hz	*
P2.03	Speed loop proportional gain 2	1–100	20	*
P2.04	Speed loop integral time 2	0.01 s–10.00 s	1.00 s	*
P2.05	Switchover frequency 2	P2.02 to maximum frequency (P0.10)	10.00 Hz	*
P2.06	Vector control slip gain	50%–200%	100%	*
P2.07	Time constant of speed loop filter	0.000 s–1.000 s	0.050 s	*
P2.08	Vector control over-excitation gain	0-200	64	*
P2.09	Torque upper limit source in speed control mode	0: P2.10 setting 1: FIV 2: FIC 3: Reserved 4: Pulse setting 5: Communication setting 6: MIN (FIV, FIC) 7: MAX (FIV, FIC) **Note:** 1–7 full scale corresponds to P2.10	0	*
P2.10	Digital setting of torque upper limit in speed control mode (motorized)	0.0%–200.0%	150.0%	*
P2.13	Flux adjustment proportional gain	0–60000	2000	*
P2.14	Flux adjustment integral gain	0–60000	1300	*
P2.15	Torque adjustment proportional gain	0–60000	2000	*
P2.16	Torque adjustment integral gain	0–60000	1300	*

Function Code	Parameter Name	Setting Range	Default	Type
P2.17	Speed loop integral property	**Unit's digit (Integral separation):** 0: Disabled 1: Enabled	0	*
P2.21	Maximum torque coefficient of field weakening area	50%–200%	100%	*
P2.22	Regenerative power limit enable	0: Disabled 1: Enabled (Full effect)	0	*

9.3.4 Group P3: V/F Control Parameters

Function Code	Parameter Name	Setting Range	Default	Type
P3.00	V/F curve setting	0: Linear V/F 1: Multi-point V/F 2: Square V/F 3: 1.2-power V/F 4: 1.4-power V/F 5: Reserved 6: 1.6-power V/F 7: Reserved 8: 1.8-power V/F 9: Reserved 10: V/F complete separation 11: V/F half separation	0	*
P3.01	Torque boost	0.0%: Automatic torque boost 0.1%–30.0%: Manual torque boost	Model dependent	✖
P3.02	Cut-off frequency of torque boost	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	✖
P3.03	Multi-point V/F frequency 1	0.00 Hz to P3.05	0.00 Hz	✖
P3.04	Multi-point V/F voltage 1	0.0%–100.0%	0.0%	✖
P3.05	Multi-point V/F frequency 2	P3.03 to P3.07	0.00 Hz	✖
P3.06	Multi-point V/F voltage 2	0.0%–100.0%	0.0%	✖
P3.07	Multi-point V/F frequency 3	P3.05 to rated motor frequency (P1.04)	0.00 Hz	✖
P3.08	Multi-point V/F voltage 3	0.0%–100.0%	0.0%	✖
P3.09	V/F slip compensation gain	0.0%–200.0%	0.0%	*

Function Code	Parameter Name	Setting Range	Default	Type
P3.10	V/F over-excitation gain	0–200	64	*
P3.11	V/F oscillation suppression gain	0–100	Model dependent	*
P3.13	Voltage source for V/F separation	0: Digital setting (P3.14) 1: FIV 2: FIC 3: Reserved 4: PULSE setting 5: Multi-step speed reference 6: Simple PLC 7: PID control 8: Communication setting **Note:** 100% corresponds to rated motor voltage	0	*
P3.14	Voltage digital setting for V/F separation	0 V to rated motor voltage (P1.02)	0 V	*
P3.15	Voltage acceleration time of V/F separation	0.0 s–1000.0 s (Voltage rise time from 0 V to rated motor voltage)	0.0 s	*
P3.16	Voltage deceleration time of V/F separation	0.0 s–1000.0 s (Voltage decline time from rated motor voltage to 0 V)	0.0 s	*
P3.17	Stop mode of V/F separation	0: Frequency and voltage decrease independently to 0 1: Frequency starts to decrease only after voltage reaches 0	0	*
P3.18	Action current of overcurrent stall	50%–200%	150%	✖
P3.19	Overcurrent stall enable	0: Disabled 1: Enabled	1	✖
P3.20	Overcurrent stall suppression gain	0–100	20	*
P3.21	Action current compensation coefficient of multiple overcurrent stall	50%–200%	50%	✖
P3.22	Action voltage of overvoltage stall	200.0 V–2000.0 V	760 V	✖
P3.23	Overvoltage stall enable	0: Disabled 1: Enabled	1	✖

Function Code	Parameter Name	Setting Range	Default	Type
P3.24	Overvoltage stall suppression gain	0–100	30	*
P3.25	Overvoltage stall suppression voltage gain	0–100	30	*
P3.26	Maximum rising frequency limit of overvoltage stall	0 Hz–50 Hz	5 Hz	✖

9.3.5 Group P4: Input Terminals

Function Code	Parameter Name	Setting Range	Default	Type
P4.00	X1 function selection	0: No function 1: Forward RUN (FWD) 2: Reverse RUN (REV) 3: Three-line control 4: Forward JOG (JOG-F) 5: Reverse JOG (JOG-R) 6: Terminal UP 7: Terminal DOWN 8: Coast to stop 9: Fault reset (RESET) 10: RUN pause 11: Normally Open (NO) input for external fault 12: Multi-step speed terminal 1 13: Multi-step speed terminal 2 14: Multi-step speed terminal 3 15: Multi-step speed terminal 4 16: Acceleration/Deceleration time selection terminal 1 17: Acceleration/Deceleration time selection terminal 2 18: Frequency source switchover 19: UP/DOWN setting clear (terminal, operation panel) 20: Command source switchover terminal 21: Acceleration/Deceleration prohibited 22: PID pause 23: PLC status reset 24: Swing pause 25: Counter input 26: Counter reset 27: Length count input 28: Length reset	1	✖

Function Code	Parameter Name	Setting Range	Default	Type
P4.01	X2 function selection	29: Torque control prohibited 30: Pulse frequency input (enabled only for X5/S3) 31: Reserved 32: Immediate DC braking 33: Normally Closed (NC) input for external fault 34: Frequency modification forbidden 35: Reverse PID action direction 36: External STOP terminal 1 37: Command source switchover terminal 2 38: PID integral pause 39: Switchover between main frequency source X and preset frequency 40: Switchover between auxiliary frequency source Y and preset frequency 41-42: Reserved 43: PID parameter switchover 44-45: Reserved 46: Speed control/Torque control switchover 47: Emergency stop 48: External STOP terminal 2 49: Deceleration DC braking 50: Clear current running time 51-59: Reserved	2	✖
P4.04	X5 function selection		13	✖
P4.10	Filter time	0.000 s–1.000 s	0.010 s	*
P4.11	Terminal command mode	0: Two-line mode 1 1: Two-line mode 2 2: Three-line mode 1 3: Three-line mode 2	0	
P4.12	Terminal UP/DOWN rate	0.001 Hz/s–65.535 Hz/s	1.00 Hz/s	*
P4.13	FI curve 1 minimum input	0.00 V to P4.15	0.00 V	*
P4.14	Corresponding setting of FI curve 1 minimum input	-100.0% to +100.0%	0.0%	*
P4.15	FI curve 1 maximum input	P4.13 to +10.00 V	10.00 V	*
P4.16	Corresponding setting of FI curve 1 maximum input	-100.0% to +100.0%	100.0%	*

Function Code	Parameter Name	Setting Range	Default	Type
P4.17	FI curve 1 filter time	0.00 s–10.00 s	0.10 s	*
P4.18	FI curve 2 minimum input	0.00 V to P4.20	0.00 V	*
P4.19	Corresponding setting of FI curve 2 minimum input	-100.0% to +100.0%	0.0%	*
P4.20	FI curve 2 maximum input	P4.18 to +10.00 V	10.00 V	*
P4.21	Corresponding setting of FI curve 2 maximum input	-100.0% to +100.0%	100.0%	*
P4.22	FI curve 2 filter time	0.00 s–10.00 s	0.10 s	*
P4.23	FI curve 3 minimum input	-10.00 V to P4.25	-10.00 V	*
P4.24	Corresponding setting of FI curve 3 minimum input	-100.0% to +100.0%	0.0%	*
P4.25	FI curve 3 maximum input	P4.23 to +10.00 V	10.00 V	*
P4.26	Corresponding setting of FI curve 3 maximum input	-100.0% to +100.0%	100.0%	*
P4.27	FI curve 3 filter time	0.00 s–10.00 s	0.10 s	*
P4.28	PULSE minimum input	0.00 kHz to P4.30	0.00 kHz	*
P4.29	Corresponding setting of pulse minimum input	-100.0% to 100.0%	0.0%	*
P4.30	PULSE maximum input	P4.28 to 100.00 kHz	50.00 kHz	*
P4.31	Corresponding setting of pulse maximum input	-100.0% to 100.0%	100.0%	*
P4.32	PULSE filter time	0.00 s–10.00 s	0.10 s	*

s

Function Code	Parameter Name	Setting Range	Default	Type
P4.33	FI curve selection	**Unit's digit (FIV curve selection):** 1: Curve 1 (2 points, see P4.13–P4.16) 2: Curve 2 (2 points, see P4.18–P4.21) 3: Curve 3 (2 points, see P4.23–P4.26) 4: Curve 4 (4 points, see C6.00–C6.07) 5: Curve 5 (4 points, see C6.08–C6.15) **Ten's digit:** FIC curve selection (1–5, same as FIV) **Hundred's digit:** Reserved	321	*
P4.34	Setting selection for FI less than minimum input	**Unit's digit (Setting for FIV less than minimum input):** 0: Corresponds to the minimum input settings 1: 0.0% **Ten's digit:** Setting selection for FIC less than minimum input (0–1, same as FIV)	000	*
P4.35	X1 delay time	0.0 s–3600.0 s	0.0 s	✖
P4.36	X2 delay time	0.0 s–3600.0 s	0.0 s	✖
P4.37	Reserved	—	—	✖
P4.38	X valid mode selection 1	0: High level active (Active High) 1: Low level active (Active Low) **Unit's digit:** X1 **Ten's digit:** X2 **Hundred's digit:** Reserved **Thousand's digit:** Reserved **Ten-thousand's digit:** X5	00000	✖
P4.39	X valid mode selection 2	0: High level active (Active High) 1: Low level active (Active Low) **Unit's digit:** Reserved **Ten's digit:** Reserved **Hundred's digit:** Reserved **Thousand's digit:** Reserved **Ten-thousand's digit:** Reserved	00000	✖

9.3.6 Group P5: Output Terminals

Function Code	Parameter Name	Setting Range	Default	Type
P5.00	MO1 terminal output mode selection	0: Pulse output (MO1-COM) 1: Digital output	0	*
P5.01	Digital output function selection via Expansion Card (MOA-MOB-MOC)	0: No output 1: AC drive running 2: Fault output 3: Frequency-level detection FDT1 output 4: Frequency reached 5: Zero-speed running (no output at stop) 6: Motor overload pre-warning 7: AC drive overload pre-warning 8: Setting count value reached 9: Designated count value reached 10: Length reached 11: PLC cycle complete 12: Accumulative running time reached 13: Frequency limited 14: Torque limited 15: Ready for RUN 16: FIV > FIC 17: Frequency upper limit reached 18: Frequency lower limit reached (related to run) 19: Undervoltage state output 20: Communication setting 21-22: Reserved 23: Zero-speed running 2 (having output at stop) 24: Accumulative power-on time reached 25: Frequency level detection FDT2 output 26: Frequency 1 reached output 27: Frequency 2 reached output 28: Current 1 reached output 29: Current 2 reached output 30: Timing reached output 31: FIV input limit exceeded 32: Load becoming 0 (Load loss) 33: Reverse running 34: Zero current state 35: Module temperature reached 36: Output current limit exceeded 37: Frequency lower limit reached (having output at stop) 38: Alarm output (keep running)	0	*
P5.02	Relay function selection (YA-YB-YC)		2	*

Function Code	Parameter Name	Setting Range	Default	Type
P5.03	Relay function selection (TA-TC)	39: Motor overheat pre-warning 40: Current running time reached 41: Fault output (no output at undervoltage)	0	*
P5.04	YO terminal output function selection		1	*
P5.05	Reserved	—	4	*
P5.06	MO1 output function selection (Analog/Pulse)	0: Running frequency 1: Set frequency 2: Output current 3: Output torque 4: Output power 5: Output voltage 6: Pulse input (100.0% for 100.0 kHz) 7: FIV 8: FIC 9: Reserved 10: Length 11: Count value 12: Communication setting 13: Motor rotational speed 14: Output current (100.0% for 1000.0 A) 15: Output voltage (100.0% for 1000.0 V) 16: Output torque (actual value, corresponding to motor percentage)	0	*
P5.07	FOV output function selection		0	*
P5.08	FOC (expansion card) output function selection		1	*
P5.09	MO1 output maximum frequency	0.01 kHz–100.00 kHz	50.00 kHz	*
P5.10	FOV bias coefficient	-100.0% to +100.0%	0.0%	*
P5.11	FOV gain	-10.00 to +10.00	1.00	*
P5.12	FOC bias coefficient	-100.0% to +100.0%	0.0%	*
P5.13	FOC gain	-10.00 to +10.00	1.00	*
P5.17	Digital output delay time (MOA-MOB-MOC)	0.0 s–3600.0 s	0.0 s	*
P5.18	YA-YB-YC output delay time	0.0 s–3600.0 s	0.0 s	*
P5.19	TA-TC output delay time	0.0 s–3600.0 s	0.0 s	*

Function Code	Parameter Name	Setting Range	Default	Type
P5.20	YO output delay time	0.0 s–3600.0 s	0.0 s	*
P5.22	Output terminal valid mode selection	0: Positive logic (Active High) 1: Negative logic (Active Low) **Unit's digit:** MOA-MOB-MOC **Ten's digit:** YA-YB-YC **Hundred's digit:** TA-TC **Thousand's digit:** YO	00000	*

9.3.7 Group P6: Start/Stop Control Parameters

Function Code	Parameter Name	Setting Range	Default	Type
P6.00	Start mode	0: Direct start 1: Rotational speed tracking restart (Catch on the fly) 2: Pre-excited start (asynchronous motor)	0	*
P6.01	Rotational speed tracking mode	0: Restart from frequency at stop 1: Restart from zero speed 2: Restart from maximum frequency	0	✖
P6.02	Rotational speed tracking speed (Rate)	1–100	20	*
P6.03	Startup frequency	0.00 Hz–10.00 Hz	0.00 Hz	*
P6.04	Startup frequency holding time	0.0 s–100.0 s	0.0 s	✖
P6.05	Startup DC braking current / Pre-excitation current	0%–100%	0%	✖
P6.06	Startup DC braking time / Pre-excitation time	0.0 s–100.0 s	0.0 s	✖
P6.07	Acceleration/Deceleration mode	0: Linear acceleration/ deceleration 1: S-curve acceleration/ deceleration A 2: Dynamic S-curve acceleration/deceleration B	0	✖
P6.08	Time proportion of S-curve start segment	0.0% to (100.0% - P6.09)	30.0%	✖
P6.09	Time proportion of S-curve end segment	0.0% to (100.0% - P6.08)	30.0%	✖

Function Code	Parameter Name	Setting Range	Default	Type
P6.10	Stop mode	0: Decelerate to stop 1: Coast to stop	0	*
P6.11	Initial frequency of stop DC braking	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*
P6.12	Waiting time of stop DC braking	0.0 s–100.0 s	0.0 s	*
P6.13	Stop DC braking current	0%–100%	0%	*
P6.14	Stop DC braking time	0.0 s–100.0 s	0.0 s	*
P6.15	Brake chopper duty ratio	0%–100%	100%	*
P6.18	Speed tracking current limit	30%–200%	Model dependent	✖
P6.21	Demagnetization time (SVC valid)	0.00 s–5.00 s	Model dependent	*

9.3.8 Group P7: Operation Panel and Display Parameters

Function Code	Parameter Name	Setting Range	Default	Type
P7.01	JOG function selection	0: No function 1: Switchover between operation panel control and remote command control (Terminal or Communication) 2: Switchover between forward and reverse rotation 3: Forward JOG 4: Reverse JOG	0	*
P7.02	STOP/RESET function selection	0: STOP/RESET key enabled only in operation panel control mode 1: STOP/RESET key enabled in any operation mode	1	*
P7.03	LED display running parameters 1	0000–FFFF (Hexadecimal / Bit-coded) Bit00: Operating frequency 1 (Hz) Bit01: Set frequency (Hz) Bit02: DC bus voltage (V) Bit03: Output voltage (V) Bit04: Output current (A) Bit05: Output power (kW) Bit06: Output torque (%) *Bit07-Bit15 see next page*	1F	*

Function Code	Parameter Name	Setting Range	Default	Type
P7.03	LED display running parameters 1	Bit07: Input terminal status Bit08: Output terminal status Bit09: FIV voltage (V) Bit10: FIC voltage (V) Bit11: Reserved Bit12: Count value Bit13: Length value Bit14: Display load speed Bit15: PID setting	1F	*
P7.04	LED display running parameters 2	0000–FFFF (Hexadecimal / Bit-coded) Bit00: PID feedback Bit01: PLC stage Bit02: PULSE input frequency (kHz) Bit03: Motor speed (rpm) Bit04: Remaining running time Bit05: FIV (expansion card) voltage before calibration (V) Bit06: FIC voltage before correction (V) Bit07: Reserved Bit08: Motor speed Bit09: Current power-on time (Hours) Bit10: Current running time (Minutes) Bit11: PULSE input frequency (Hz) Bit12: Communication set value Bit13: Encoder feedback speed (Hz) Bit14: Display of main frequency X (Hz) Bit15: Display of aux. frequency Y (Hz)	0	*
P7.05	LED display stop parameters	0000–FFFF (Hexadecimal / Bit-coded) Bit00: Set frequency (Hz) Bit01: DC bus voltage (V) Bit02: DI input status Bit03: DO output status Bit04: FIV voltage (V) Bit05: FIC voltage (V) Bit06: Reserved Bit07: Count value Bit08: Length value Bit09: PLC stage Bit10: Load speed Bit11: PID setting Bit12: Pulse setting frequency (kHz)	33	*
P7.06	Load speed display coefficient	0.0001–6.5000	1.0000	*
P7.07	Heatsink temperature of inverter	0.0°C–120.0°C	—	●
P7.08	Rectifier bridge radiator temperature	0.0°C–120.0°C	—	●

Function Code	Parameter Name	Setting Range	Default	Type
P7.09	Accumulative running time	0 h–65535 h	—	●
P7.10	Performance software version number	—	—	●
P7.11	Function software version	—	—	●
P7.12	Load speed display decimal point	**Unit's digit (Number of decimal points for D0.14):** 0: 0 decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places **Ten's digit (Number of decimal points for D0.19/D0.29):** 1: 1 decimal place 2: 2 decimal places	21	*
P7.13	Accumulative power-on time	0 h–65535 h	—	●
P7.14	Accumulative power consumption	0 kWh–65535 kWh	—	●

9.3.9 Group P8: Auxiliary Functions

Function Code	Parameter Name	Setting Range	Default	Type
P8.00	JOG running frequency	0.00 Hz to maximum frequency (P0.10)	2.00 Hz	*
P8.01	JOG acceleration time	0.0 s–6500.0 s	20.0 s	*
P8.02	JOG deceleration time	0.0 s–6500.0 s	20.0 s	*
P8.03	Acceleration time 2	0.0 s–6500.0 s	Model dependent	*
P8.04	Deceleration time 2	0.0 s–6500.0 s	Model dependent	*
P8.05	Acceleration time 3	0.0 s–6500.0 s	Model dependent	*
P8.06	Deceleration time 3	0.0 s–6500.0 s	Model dependent	*
P8.07	Acceleration time 4	0.0 s–6500.0 s	Model dependent	*

Function Code	Parameter Name	Setting Range	Default	Type
P8.08	Deceleration time 4	0.0 s–6500.0 s	Model dependent	*
P8.09	Jump frequency 1	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*
P8.10	Jump frequency 2	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*
P8.11	Frequency jump amplitude	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*
P8.12	Forward/Reverse rotation dead-zone time	0.0 s–3000.0 s	0.0 s	*
P8.13	Reverse control	0: Enabled 1: Disabled	0	*
P8.14	Running mode when set frequency is lower than lower limit	0: Run at lower limit frequency 1: Stop 2: Run at zero speed	0	*
P8.15	Droop control	0.00 Hz–10.00 Hz	0.00 Hz	*
P8.16	Accumulative power-on time threshold	0 h–65000 h	0 h	*
P8.17	Accumulative running time threshold	0 h–65000 h	0 h	*
P8.18	Startup protection	0: Disabled 1: Enabled	0	*
P8.19	Frequency detection value (FDT1)	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	*
P8.20	Frequency detection hysteresis (FDT1)	0.0%–100.0% (FDT1 level)	5.0%	*
P8.21	Detection range of frequency reached	0.0%–100.0% (Maximum frequency)	0.0%	*
P8.22	Jump frequency during acceleration/deceleration	0: Disabled 1: Enabled	0	*
P8.25	Frequency switchover point between acceleration time 1 and 2	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*

Function Code	Parameter Name	Setting Range	Default	Type
P8.26	Frequency switchover point between deceleration time 1 and 2	0.00 Hz to maximum frequency (P0.10)	0.00 Hz	*
P8.27	Terminal JOG preferred	0: Disabled 1: Enabled	0	*
P8.28	Frequency detection value (FDT2)	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	*
P8.29	Frequency detection hysteresis (FDT2)	0.0%–100.0% (FDT2 level)	5.0%	*
P8.30	Any frequency reaching detection value 1	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	*
P8.31	Any frequency reaching detection amplitude 1	0.0%–100.0% (Maximum frequency)	0.0%	*
P8.32	Any frequency reaching detection value 2	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	*
P8.33	Any frequency reaching detection amplitude 2	0.0%–100.0% (Maximum frequency)	0.0%	*
P8.34	Zero current detection level	0.0%–300.0% (100.0% corresponds to rated motor current)	5.0%	*
P8.35	Zero current detection delay time	0.01 s–600.00 s	0.10 s	*
P8.36	Output overcurrent threshold	0.0% (No detection) 0.1%–300.0% (Rated motor current)	200.0%	*
P8.37	Output overcurrent detection delay time	0.00 s–600.00 s	0.00 s	*
P8.38	Any current reaching value 1	0.0%–300.0% (Rated motor current)	100.0%	*
P8.39	Any current reaching 1 amplitude	0.0%–300.0% (Rated motor current)	0.0%	*
P8.40	Any current reaching value 2	0.0%–300.0% (Rated motor current)	100.0%	*
P8.41	Any current reaching 2 amplitude	0.0%–300.0% (Rated motor current)	0.0%	*
P8.42	Timing function selection	0: Disabled 1: Enabled	0	*

Function Code	Parameter Name	Setting Range	Default	Type
P8.43	Timing duration source	0: P8.44 setting 1: FIV 2: FIC 3: Reserved (Note: 100% of analog input corresponds to P8.44 value)	0	*
P8.44	Timing duration setting	0.0 Min–6500.0 Min	0.0 Min	*
P8.45	FIV input voltage lower limit protection value	0.00 V to P8.46	3.10 V	*
P8.46	FIV input voltage upper limit protection value	P8.45 to 11.00 V	6.80 V	*
P8.47	Module temperature threshold	0°C–100°C	15°C	*
P8.48	Cooling fan control	0: Fan working during running 1: Fan working continuously	0	*
P8.49	Wakeup frequency	Dormant frequency (P8.51) to maximum frequency (P0.10)	0.00 Hz	*
P8.50	Wakeup delay time	0.0 s–6500.0 s	0.0 s	*
P8.51	Dormant frequency	0.00 Hz to wakeup frequency (P8.49)	0.00 Hz	*
P8.52	Dormant delay time	0.0 s–6500.0 s	0.0 s	*
P8.53	Current running time reached setting	0.0 Min–6500.0 Min	0.0 Min	*
P8.54	Output power correction coefficient	0%–200%	100%	*

9.3.10 Group P9: Fault and Protection Parameters

Function Code	Parameter Name	Setting Range	Default	Type
P9.00	Motor overload protection selection	0: Disabled 1: Enabled	1	*
P9.01	Motor overload protection gain	0.20–10.00	1.00	*
P9.02	Motor overload warning coefficient	50%–100%	80%	*
P9.03	Overvoltage stall gain	0–100	30	*
P9.04	Overvoltage stall protective voltage	200.0 V–2000.0 V	760.0 V	*
P9.07	Short-circuit to ground upon power-on	0: Disabled 1: Enabled	1	*
P9.09	Fault auto-reset times	0–20	0	*
P9.10	MOA-MOB-MOC action during fault auto-reset	0: No action 1: Action	0	*
P9.11	Time interval of fault auto-reset	0.1 s–100.0 s	1.0 s	*
P9.12	Input phase loss / contactor pick-up protection selection	**Unit's digit:** Reserved **Ten's digit:** Contactor pick-up protection selection 0: Disabled 1: Enabled	11	*
P9.13	Output phase loss protection selection	0: Disabled 1: Enabled	1	*
P9.14	1st (oldest) fault type	0: No fault 1: Reserved 2: Overcurrent during acceleration 3: Overcurrent during deceleration 4: Overcurrent at constant speed 5: Overvoltage during acceleration 6: Overvoltage during deceleration 7: Overvoltage at constant speed 8: Snubber resistor overload 9: Undervoltage 10: AC drive overload 11: Motor overload 12: Input phase loss 13: Output phase loss 14: Module overheat 15: External equipment fault	—	●

Function Code	Parameter Name	Setting Range	Default	Type
P9.15	2nd fault type	16: Communication fault 17: Contactor fault 18: Current detection fault 19: Motor auto-tuning fault 20: Encoder/PG card fault 21: Parameters read-write fault 22: AC drive hardware fault 23: Short circuit to ground 24–25: Reserved 26: Accumulative running time reached 27–28: Reserved 29: Accumulative power-on time reached 30: Load becoming 0 (Load loss) 31: PID feedback lost during running 40: Rapid limit timeout 41: Switch motor during running 42: Speed deviation too large 43: Motor overspeed 45: Reserved	—	●
P9.16	3rd (latest) fault type		—	●
P9.17	Frequency upon 3th (latest) fault	Read-only	—	●
P9.18	Current upon 3th (latest) fault	Read-only	—	●
P9.19	Bus voltage upon 3th (latest) fault	Read-only	—	●
P9.20	Input terminal status upon 3th (latest) fault	Read-only	—	●
P9.21	Output terminal status upon 3th (latest) fault	Read-only	—	●
P9.22	AC drive status upon 3th (latest) fault	Read-only	—	●
P9.23	Power-on time upon 3th (latest) fault	Read-only	—	●
P9.24	Running time upon 3th (latest) fault	Read-only	—	●
P9.27	Frequency upon 2nd fault	Read-only	—	●
P9.28	Current upon 2nd fault	Read-only	—	●

Function Code	Parameter Name	Setting Range	Default	Type
P9.29	Bus voltage upon 2nd fault	Read-only	—	●
P9.30	Input terminal status upon 2nd fault	Read-only	—	●
P9.31	Output terminal status upon 2nd fault	Read-only	—	●
P9.32	AC drive status upon 2nd fault	Read-only	—	●
P9.33	Power-on time upon 2nd fault	Read-only	—	●
P9.34	Running time upon 2nd fault	Read-only	—	●
P9.37	Frequency upon 1st fault	Read-only	—	●
P9.38	Current upon 1st fault	Read-only	—	●
P9.39	Bus voltage upon 1st fault	Read-only	—	●
P9.40	Input terminal status upon 1st fault	Read-only	—	●
P9.41	Output terminal status upon 1st fault	Read-only	—	●
P9.42	AC drive status upon 1st fault	Read-only	—	●
P9.44	Running time upon 1st fault	Read-only	—	●
P9.47	Fault protection action selection 1	**Unit's digit (Motor overload OL1):** 0: Coast to stop 1: Stop according to stop mode 2: Continue to run **Ten's digit:** Reserved **Hundred's digit:** Power output phase loss (LO) **Thousand's digit:** External equipment fault (EF) **Ten thousand's digit:** Communication fault (CE)	00000	*

Function Code	Parameter Name	Setting Range	Default	Type
P9.48	Fault protection action selection 2	**Unit's digit:** Reserved 0: Coast to stop **Ten's digit (Parameter read-write fault EEP):** 0: Coast to stop 1: Stop according to stop mode **Hundred's digit:** Reserved **Thousand's digit:** Reserved **Ten thousand's digit:** Accumulative running time reached (END1)	00000	*
P9.49	Fault protection action selection 3	**Unit's digit:** Reserved 0: Coast to stop 1: Stop according to stop mode 2: Continue to run **Ten's digit:** Reserved 0: Coast to stop 1: Stop according to stop mode 2: Continue to run **Hundred's digit:** Accumulative power-on time reached (END2) 0: Coast to stop 1: Stop according to stop mode 2: Continue to run **Thousand's digit (Load becoming 0 / LOAD):** 0: Coast to stop 1: Stop according to stop mode 2: Continue to run at 7% of rated motor frequency and resume to set frequency if load recovers **Ten thousand's digit:** PID feedback loss during running (PIDE) 0: Coast to stop 1: Stop according to stop mode 2: Continue to run	00000	*
P9.50	Fault protection action selection 4	**Unit's digit (Speed deviation too large 42):** 0: Coast to stop 1: Stop according to stop mode 2: Continue to run **Ten's digit:** Reserved **Hundred's digit:** Reserved	00000	*
P9.54	Frequency selection for continuing to run	0: Current running frequency 1: Set frequency 2: Upper limit frequency 3: Lower limit frequency 4: Backup frequency upon abnormality	0	*

Function Code	Parameter Name	Setting Range	Default	Type
P9.55	Backup frequency upon abnormality	0.0%–100.0% (100.0% corresponds to maximum frequency P0.10)	100.0%	*
P9.56	Motor temperature protection sensor selection	0: Inactive 1: PT100 2: PT1000 3: KTY84 4: PTC (1.5 K) 5: PTC (4 K)	0	*
P9.57	Motor over-temperature protection threshold	0–200 °C	110	*
P9.58	Motor over-temperature alarm threshold	0–200 °C	90	*
P9.59	Action selection at instantaneous power failure	0: Inactive 1: Decelerate 2: Decelerate to stop	0	*
P9.60	Action pause judging voltage at instant. power failure	80%–100%	85%	*
P9.61	Voltage recovery judging time at instant. power failure	0.0 s–100.0 s	0.5 s	*
P9.62	Action judging voltage at instantaneous power failure	60.0%–100.0% (Default DC bus voltage)	80.0%	*
P9.63	Protection upon load becoming 0	0: Disabled 1: Enabled	0	*
P9.64	Detection level of load becoming 0	0.0%–100.0%	10.0%	*
P9.65	Detection time of load becoming 0	0.0 s–60.0 s	1.0 s	*

Function Code	Parameter Name	Setting Range	Default	Type
P9.67	Overspeed detection value	0.0%–50.0% (Maximum frequency P0.10)	20.0%	*
P9.68	Overspeed detection time	0.0 s–60.0 s	1.0 s	*
P9.69	Detection value of speed deviation too large	0.0%–50.0% (Maximum frequency P0.10)	20.0%	*
P9.70	Detection time of speed deviation too large	0.0 s–60.0 s	5.0 s	*
P9.71	Instantaneous power failure gain	0–100	40	*
P9.72	Instantaneous power failure integral coefficient	0–100	30	*
P9.73	Instantaneous power failure action deceleration time	0.0 s–300.0 s	20.0 s	✖

9.3.11 Group PA: PID Function

Function Code	Parameter Name	Setting Range	Default	Type
PA.00	PID setting source	0: Digital setting (PA.01) 1: FIV 2: FIC 3: Reserved 4: PULSE setting 5: Communication setting 6: Multi-reference	0	*
PA.01	PID digital setting	0.0%–100.0%	50.0%	*
PA.02	PID feedback source	0: FIV 1: FIC 2: Reserved 3: FIV - FIC 4: PULSE setting 5: Communication setting 6: FIV + FIC 7: MAX (FIV, FIC) 8: MIN (FIV, FIC)	0	*
PA.03	PID action direction	0: Forward action 1: Reverse action	0	*
PA.04	PID setting feedback range	0–65535	1000	*
PA.05	Proportional gain Kp1	0.0–100.0	20.0	*
PA.06	Integral time Ti1	0.01 s–10.00 s	2.00 s	*
PA.07	Differential time Td1	0.000 s–10.000 s	0.000 s	*
PA.08	Cut-off frequency of PID reverse	0.00 Hz to maximum frequency (P0.10)	2.00 Hz	*
PA.09	PID deviation limit	0.0%–100.0%	0.0%	*
PA.10	PID differential limit	0.00%–100.00%	0.10%	*
PA.11	PID setting change time	0.00 s–650.00 s	0.00 s	*
PA.12	PID feedback filter time	0.00 s–60.00 s	0.00 s	*
PA.13	PID output filter time	0.00 s–60.00 s	0.00 s	*
PA.15	Proportional gain Kp2	0.0–100.0	20.0	*

Function Code	Parameter Name	Setting Range	Default	Type
PA.16	Integral time Ti2	0.01 s–10.00 s	2.00 s	*
PA.17	Differential time Td2	0.000 s–10.000 s	0.000 s	*
PA.18	PID parameter switchover condition	0: No switchover 1: Switchover via X (Digital input) 2: Automatic switchover based on deviation 3: Automatic switchover based on running frequency	0	*
PA.19	PID parameter switchover deviation 1	0.0% to PA.20	20.0%	*
PA.20	PID parameter switchover deviation 2	PA.19 to 100.0%	80.0%	*
PA.21	PID initial value	0.0%–100.0%	0.0%	*
PA.22	PID initial value holding time	0.00 s–650.00 s	0.00 s	*
PA.25	PID integral property	**Unit's digit (Integral separation):** 0: Disabled 1: Enabled **Ten's digit (Stop integral operation when output reaches limit):** 0: Continue integral operation 1: Stop integral operation	00	*
PA.26	Detection value of PID feedback loss	0.0%: No feedback loss detection 0.1%–100.0%	0.0%	*
PA.27	Detection time of PID feedback loss	0.0 s–20.0 s	0.0 s	*
PA.28	PID stop operation	0: No PID operation at stop 1: PID operation at stop	0	*

9.3.12 Group PC: Multi-Reference Speed and Simple PLC Functions

Function Code	Parameter Name	Setting Range	Default	Type
PC.00	Multi-Reference 0 (Setpoint stage 0)	-100.0% to +100.0%	0.0%	*
PC.01	Multi-Reference 1 (Setpoint stage 1)	-100.0% to +100.0%	0.0%	*
PC.02	Multi-Reference 2 (Setpoint stage 2)	-100.0% to +100.0%	0.0%	*
PC.03	Multi-Reference 3 (Setpoint stage 3)	-100.0% to +100.0%	0.0%	*
PC.04	Multi-Reference 4 (Setpoint stage 4)	-100.0% to +100.0%	0.0%	*
PC.05	Multi-Reference 5 (Setpoint stage 5)	-100.0% to +100.0%	0.0%	*
PC.06	Multi-Reference 6 (Setpoint stage 6)	-100.0% to +100.0%	0.0%	*
PC.07	Multi-Reference 7 (Setpoint stage 7)	-100.0% to +100.0%	0.0%	*
PC.08	Multi-Reference 8 (Setpoint stage 8)	-100.0% to +100.0%	0.0%	*
PC.09	Multi-Reference 9 (Setpoint stage 9)	-100.0% to +100.0%	0.0%	*
PC.10	Multi-Reference 10 (Setpoint stage 10)	-100.0% to +100.0%	0.0%	*
PC.11	Multi-Reference 11 (Setpoint stage 11)	-100.0% to +100.0%	0.0%	*
PC.12	Multi-Reference 12 (Setpoint stage 12)	-100.0% to +100.0%	0.0%	*
PC.13	Multi-Reference 13 (Setpoint stage 13)	-100.0% to +100.0%	0.0%	*
PC.14	Multi-Reference 14 (Setpoint stage 14)	-100.0% to +100.0%	0.0%	*
PC.15	Multi-Reference 15 (Setpoint stage 15)	-100.0% to +100.0%	0.0%	*
PC.16	Simple PLC running mode	0: Stop after the AC drive runs one cycle 1: Keep final values after the AC drive runs one cycle 2: Repeat after the AC drive runs one cycle	0	*

Function Code	Parameter Name	Setting Range	Default	Type
PC.17	Simple PLC retentive selection	**Unit's digit (Retentive upon power failure selection):** 0: Non-retentive 1: Retentive **Ten's digit (Retentive upon stop selection):** 0: Non-retentive 1: Retentive	00	*
PC.18	Running time of simple PLC reference 0	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.19	Acceleration/Deceleration time of simple PLC reference 0	0–3	0	*
PC.20	Running time of simple PLC reference 1	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.21	Acceleration/Deceleration time of simple PLC reference 1	0–3	0	*
PC.22	Running time of simple PLC reference 2	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.23	Acceleration/Deceleration time of simple PLC reference 2	0–3	0	*
PC.24	Running time of simple PLC reference 3	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.25	Acceleration/Deceleration time of simple PLC reference 3	0–3	0	*
PC.26	Running time of simple PLC reference 4	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.27	Acceleration/Deceleration time of simple PLC reference 4	0–3	0	*
PC.28	Running time of simple PLC reference 5	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*

Function Code	Parameter Name	Setting Range	Default	Type
PC.29	Acceleration/Deceleration time of simple PLC reference 5	0–3	0	*
PC.30	Running time of simple PLC reference 6	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.31	Acceleration/Deceleration time of simple PLC reference 6	0–3	0	*
PC.32	Running time of simple PLC reference 7	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.33	Acceleration/Deceleration time of simple PLC reference 7	0–3	0	*
PC.34	Running time of simple PLC reference 8	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.35	Acceleration/Deceleration time of simple PLC reference 8	0–3	0	*
PC.36	Running time of simple PLC reference 9	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.37	Acceleration/Deceleration time of simple PLC reference 9	0–3	0	*
PC.38	Running time of simple PLC reference 10	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.39	Acceleration/Deceleration time of simple PLC reference 10	0–3	0	*
PC.40	Running time of simple PLC reference 11	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.41	Acceleration/Deceleration time of simple PLC reference 11	0–3	0	*

Function Code	Parameter Name	Setting Range	Default	Type
PC.42	Running time of simple PLC reference 12	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.43	Acceleration/Deceleration time of simple PLC reference 12	0–3	0	*
PC.44	Running time of simple PLC reference 13	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.45	Acceleration/Deceleration time of simple PLC reference 13	0–3	0	*
PC.46	Running time of simple PLC reference 14	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.47	Acceleration/Deceleration time of simple PLC reference 14	0–3	0	*
PC.48	Running time of simple PLC reference 15	0.0 s(h)–6500.0 s(h)	0.0 s(h)	*
PC.49	Acceleration/Deceleration time of simple PLC reference 15	0–3	0	*
PC.50	Time unit of simple PLC running	0: s (second) 1: h (hour)	0	*
PC.51	Multi-step speed reference 0 setting mode	0: Set by PC.00 1: FIV 2: FIC 3: Reserved 4: PULSE setting 5: PID control 6: Preset frequency (P0.08) digital setting, UP/DOWN modifiable	0	*

9.3.13 Group PD: Communication Parameters

Function Code	Parameter Name	Setting Range	Default	Type
PD.00	Baud rate selection	**Unit's digit (MODBUS):** 0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps **Ten's digit:** Reserved **Hundred's digit:** Reserved **Thousand's digit (CAN):** 0: 20 Kbps 1: 50 Kbps 2: 100 Kbps 3: 125 Kbps 4: 250 Kbps 5: 500 Kbps 6: 1 Mbps	5005	*
PD.01	Data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	3	*
PD.02	Local communication address	1–247	1	*
PD.03	Response delay	0 ms–20 ms	2	*
PD.04	Communication timeout	0.0 s: Inactive (monitoring disabled) 0.1 s–60.0 s	0.0	*
PD.05	Data transfer format selection	**Unit's digit (MODBUS):** 0: Non-Default MODBUS protocol 1: Default MODBUS protocol **Ten's digit:** Reserved	1	*
PD.06	Communication reading current resolution	0: 0.01 A 1: 0.1 A	0	*

9.3.14 Group PP: User-Defined Function Codes

Function Code	Parameter Name	Setting Range	Default	Type
PP.00	User password	0–65535 (0: No password protected)	0	*
PP.01	Parameter initialization	0: No operation 1: Restore factory defaults (except motor parameters)	0	✖

9.3.15 Group C0: Torque Control and Restricting Parameters

Function Code	Parameter Name	Setting Range	Default	Type
C0.00	Speed/Torque control selection	0: Speed control 1: Torque control	0	✖
C0.01	Torque setting source selection in torque control	0: Digital setting (C0.03) 1: FIV 2: FIC 3: Reserved 4: PULSE setting 5: Communication setting 6: MIN (FIV, FIC) 7: MAX (FIV, FIC) (Note: 1–7 full scale corresponds to C0.03 digital setting)	0	✖
C0.03	Torque digital setting in torque control	-200.0% to +200.0%	150.0%	*
C0.05	Forward maximum frequency in torque control	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	*
C0.06	Reverse maximum frequency in torque control	0.00 Hz to maximum frequency (P0.10)	50.00 Hz	*
C0.07	Acceleration time in torque control	0.00 s–650.00 s	0.00 s	*
C0.08	Deceleration time in torque control	0.00 s–650.00 s	0.00 s	*

9.3.16 Group C5: Control Optimization Parameters

Function Code	Parameter Name	Setting Range	Default	Type
C5.00	DPWM switchover frequency upper limit	5.00 Hz to maximum frequency (P0.10)	8.00 Hz	*
C5.01	PWM modulation mode	0: Asynchronous modulation 1: Synchronous modulation	0	*
C5.02	Dead-zone compensation mode selection	0: No compensation 1: Compensation mode 1	1	*
C5.03	Random PWM depth	0: Random PWM inactive 1–10: PWM carrier frequency random depth	0	*
C5.04	Fast current limitation	0: Disabled 1: Enabled	1	*
C5.05	Voltage overmodulation coefficient	100–110	105	*
C5.06	Undervoltage threshold setting	200.0 V–2000.0 V	Model dependent	*
C5.07	SVC optimization mode selection	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	*
C5.08	Dead-zone time adjustment	100%–200%	150%	*
C5.09	Overvoltage threshold setting	200.0 V–2200.0 V	Model dependent	*

9.3.17 Group d0: Monitoring Parameters

Function Code	Parameter Name	Resolution	Unit
d0.00	Running frequency	0.01	Hz
d0.01	Set frequency	0.01	Hz
d0.02	DC bus voltage	0.1	V
d0.03	Output voltage	1	V
d0.04	Output current	0.01	A
d0.05	Output power	0.1	kW
d0.06	Output torque	0.1	%
d0.07	DI input status	1	—
d0.08	DO output status	1	—
d0.09	FIV voltage	0.01	V
d0.10	FIC voltage	0.01	V
d0.11	Reserved	—	—
d0.12	Count value	1	—
d0.13	Length value	1	—
d0.14	Load speed display	1	—
d0.15	PID setting	1	—
d0.16	PID feedback	1	—
d0.17	PLC stage	1	—
d0.18	Input pulse frequency	0.01	kHz
d0.19	Motor speed	1	rpm
d0.20	Remaining running time	0.1	min
d0.21	FIV voltage before correction	0.001	V
d0.22	FIC voltage before correction	0.001	V
d0.23	Reserved	—	—

Function Code	Parameter Name	Resolution	Unit
d0.24	Linear speed	1	m/min
d0.25	Current power-on time	1	min
d0.26	Current running time	0.1	min
d0.27	Input pulse frequency	1	Hz
d0.28	Communication setting	0.01	%
d0.29	Encoder feedback frequency	0.01	Hz
d0.30	Main frequency X display	0.01	Hz
d0.31	Auxiliary frequency Y display	0.01	Hz
d0.32	View any memory address values	1	—
d0.33	Reserved	—	—
d0.34	Motor temperature value	1	°C
d0.35	Target torque	0.1	%
d0.36	Resolver position	1	—
d0.37	Power factor angle	0.1	°
d0.38	ABZ position	1	—
d0.39	Target voltage upon V/F separation	1	V
d0.40	Output voltage upon V/F separation	1	V
d0.41	Reserved	—	—
d0.42	Reserved	—	—
d0.43	Reserved	—	—
d0.44	Reserved	—	—
d0.45	Fault information	1	—
d0.58	Z signal counter	1	—
d0.59	Setting frequency percentage	0.01	%
d0.60	Running frequency percentage	0.01	%

Function Code	Parameter Name	Resolution	Unit
d0.61	AC drive state	1	—
d0.74	AC drive output torque	0.1	%

10. Dismantling and Disposal

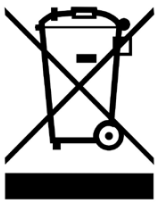
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10.1 Regulations



The frequency inverter contains electronic components and valuable raw materials. It must not be disposed of with household waste.

For disposal, observe the regulations for waste electrical and electronic equipment applicable in your country (in the EU the WEEE Directive 2012/19/EU) as well as all relevant environmental protection standards.

10.2 Recycling and Reuse

Before dismantling, disconnect the frequency inverter from the mains on all poles and wait at least 10 minutes until the DC bus capacitors have discharged. Dismantling may only be carried out by a qualified electrician.



Reusing devices that are still functional in another system is always worth considering. Mecheltron GmbH & Co. KG will be pleased to advise you on the specific options.

Hand in the frequency inverter as waste electrical equipment at a suitable collection point. In Germany, private users can use the municipal recycling centres; commercial users should contact a certified waste disposal company.

Appendix A – Modbus Communication Protocol

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A.9 Communication Parameters (Group PD) 198

A.1 General

The VCD100 AC drive provides an RS-485 interface (terminals RS+ / RS−) and supports the Modbus RTU communication protocol. A host computer (PC) or PLC can use it to send running commands and setpoints, read and modify parameters, and read the operating status and fault information of the AC drive.
The protocol defines the content and format of the serial data transmission: the format of the master request (single query or broadcast) with command code, data and error check, and the slave response with the same structure (acknowledgement, requested data, error check). If the slave detects an error on reception or cannot execute the request, it returns a fault message to the master.

A.2 Bus Structure

Item	Description
Interface	RS-485 (hardware)
Transmission	Asynchronous, serial, half-duplex. Only one device (the master or one slave) transmits at a time, all others receive. Data is transmitted frame by frame.
Topology	Single master, several slaves. Slave addresses 1–247, address 0 is the broadcast address. Each slave address must be unique in the network.
Bus termination	At the end of the bus, switch on the termination resistor with jumper J4 (see chapter 4.4).

The AC drive operates as a slave in a single-master network (PC or PLC).

A.3 Protocol Description

The VCD100 Modbus protocol is an asynchronous master-slave protocol. Only one device, the master (PC, industrial controller or PLC), initiates a transmission (query/command). The slaves (VCD100) respond with the requested data or perform the requested action. The master can address a single slave or send a broadcast message to all slaves. A slave returns a response to a single query; slaves do not respond to broadcast messages.

A.4 Data Frame (RTU Mode)

RTU mode is used. Each message starts after a silent interval of at least 3.5 character times. The first field transmitted is the slave address. The permitted characters are the hexadecimal characters 0…9 and A…F. All devices monitor the bus continuously, including the silent intervals. When the address field has been received, each device checks whether the message is addressed to it. After the last character, a silent interval of at least 3.5 character times marks the end of the message; a new message can start after this interval.
The entire frame must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs before the frame is complete, the receiver discards the incomplete message and treats the next byte as the address field of a new message. If a new message follows the previous one within less than 3.5 character times, the receiver treats it as a continuation of the previous message. This causes an error because the CRC value will not be correct.

RTU frame format:

Field	Content
START	Silent interval of at least 3.5 character times
ADR (slave address)	Communication address 1–247
CMD (command code)	03H: read parameters; 06H: write parameters
DATA (N−1) … DATA (0)	Data content: parameter address, number of parameters, parameter values, etc.
CRC CHK low byte	CRC check value
CRC CHK high byte	CRC check value
END	Silent interval of at least 3.5 character times

A.5 Command Codes and Examples

Command code 03H: read words

Command code 03H reads N words, up to 12 consecutive words. Example: two consecutive values are read from the AC drive with slave address 01H, starting at address F105H.

Master request:

Field	Value
ADR	01H
CMD	03H
Start address high byte	F1H
Start address low byte	05H
Number of registers high byte	00H
Number of registers low byte	02H
CRC CHK low byte	CRC value (to be calculated)
CRC CHK high byte	CRC value (to be calculated)

Slave response with PD.05 = 0 (non-standard Modbus protocol):

Field	Value
ADR	01H
CMD	03H
Number of bytes high byte	00H
Number of bytes low byte	04H
1st value high byte	00H
1st value low byte	00H
2nd value high byte	00H
2nd value low byte	01H
CRC CHK low byte	CRC value (to be calculated)
CRC CHK high byte	CRC value (to be calculated)

Slave response with PD.05 = 1 (standard Modbus protocol):

Field	Value
ADR	01H
CMD	03H
Number of bytes	04H
1st value high byte	00H
1st value low byte	00H
2nd value high byte	00H
2nd value low byte	01H
CRC CHK low byte	CRC value (to be calculated)
CRC CHK high byte	CRC value (to be calculated)

Command code 06H: write one word

Example: the value 40000 (9C40H) is written to address F00AH (P0.10 maximum frequency) of the AC drive with slave address 05H; this corresponds to 400.00 Hz.

Master request:

Field	Value
ADR	05H
CMD	06H
Data address high byte	F0H
Data address low byte	0AH
Data content high byte	9CH
Data content low byte	40H
CRC CHK low byte	CRC value (to be calculated)
CRC CHK high byte	CRC value (to be calculated)

Slave response:

Field	Value
ADR	05H
CMD	06H
Data address high byte	F0H
Data address low byte	0AH
Data content high byte	9CH
Data content low byte	40H
CRC CHK low byte	CRC value (to be calculated)
CRC CHK high byte	CRC value (to be calculated)

A.6 CRC Check

In RTU mode, each message contains an error check field based on the CRC method (Cyclical Redundancy Check), which checks the entire content of the message. The CRC field consists of two bytes and contains a 16-bit binary value. The transmitter calculates the CRC value and appends it to the message. The receiver recalculates the CRC value of the received message and compares it with the received value. If the two values differ, a transmission error has occurred.
At the start, the CRC register is preset to 0xFFFF. The consecutive 8-bit bytes of the message are then processed with the register contents. Only the 8 data bits of each character are used; start, stop and parity bits are ignored.
Each byte is exclusive-ORed (XOR) with the register contents. The result is shifted towards the least significant bit (LSB) and the most significant bit (MSB) is filled with 0. If the shifted-out LSB is 1, the register is XORed with the fixed value 0xA001; if it is 0, this step is skipped. This is repeated eight times. The next byte is then XORed with the current register contents. After the last byte of the message, the register contains the CRC value.
The CRC value is appended to the message low byte first, followed by the high byte.

Example CRC function (C):

```
unsigned int crc_cal_value(unsigned char *data_value, unsigned char data_length)
{
    int i;
    unsigned int crc_value = 0xFFFF;
    while (data_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;
}
```

A.7 Parameter Addressing

Communication is used to control the AC drive, read its operating status and set parameters. A parameter (function code) is accessed via a 16-bit address made up of the parameter group and the parameter number:

Byte	Meaning
High byte	F0–FF: groups P0–PF; A0–AF: groups C0–CF; 70–7F: group d
Low byte	00–FF: parameter number (hexadecimal)

Example: P3.12 has the address F30CH (group P3 → F3H, number 12 → 0CH).



Note:
Group PF parameters can neither be read nor changed via communication. Group d parameters are read-only.

Some parameters must not be changed while the AC drive is running; others cannot be changed in any state. When changing parameters, also observe the setting range, unit and notes for the parameter (see chapters 6 and 9).
Frequent storage in the EEPROM shortens its service life. For parameters that are changed frequently via communication, it is therefore usually sufficient to change only the value in RAM. To do this, change the upper nibble of the address from F to 0 for P groups and from A to 4 for C groups. The addresses are then: high byte 00–0F (P groups) or 40–4F (C groups), low byte 00–FF. Examples: P3.12 without storage in the EEPROM: address 030CH; C0.05 without storage in the EEPROM: address 4005H. These addresses can only be written (RAM); a read access to them is treated as an invalid address.

A.8 Operating Data, Control and Status Addresses

Operating data (read-only)

Address	Description
1000	Communication setting value (−10000 to 10000, decimal)
1001	Running frequency
1002	DC bus voltage

Address	Description
1003	Output voltage
1004	Output current
1005	Output power
1006	Output torque
1007	Running speed
1008	Input terminal status
1009	Output terminal status
100A	FIV voltage
100B	FIC voltage
100C	Reserved
100D	Count value input
100E	Length value input
100F	Load speed
1010	PID setting
1011	PID feedback
1012	PLC step
1013	Pulse input frequency, unit 0.01 kHz
1014	Reserved
1015	Remaining running time
1016	FIV voltage before correction
1017	FIC voltage before correction
1018	Reserved
1019	Linear speed
101A	Current power-on time
101B	Current running time
101C	Pulse input frequency, unit 1 Hz
101D	Communication setting value
101E	Reserved
101F	Main frequency X display

Address	Description
1020	Auxiliary frequency Y display



Note:
The communication setting value is a relative percentage: 10000 corresponds to 100.00 %, −10000 to −100.00 %. For frequency values, the percentage refers to the maximum frequency (P0.10); for torque values, it refers to P2.10.

Control commands to the AC drive (write-only)

Address	Command
2000	0001: Forward run
2000	0002: Reverse run
2000	0003: Forward jog
2000	0004: Reverse jog
2000	0005: Coast to stop
2000	0006: Decelerate to stop
2000	0007: Fault reset

AC drive status (read-only)

Address	Status
3000	0001: Forward running
3000	0002: Reverse running
3000	0003: Stop

Parameter password check

Address	Content
1F00	Entered password

If 8888H is returned, the password check has been passed.

Digital output control (write-only)

Address	Content
2001	BIT0: Reserved
2001	BIT1: YO output control
2001	BIT2: TA-TC output control
2001	BIT3: YA-YB-YC output control
2001	BIT4: MOA-MOB-MOC / MO1 output control

Analog and pulse output control (write-only)

Address	Content
2002	Analog output FOV: 0–7FFFH correspond to 0–1000
2003	Analog output FOC: 0–7FFFH correspond to 0–1000
2004	Pulse output: 0–7FFFH correspond to 0–1000

Fault information (address 8000H)

Code	Fault	Display
0000	No fault	—
0001	Inverter unit protection	OC
0002	Overcurrent during acceleration	OC1
0003	Overcurrent during deceleration	OC2
0004	Overcurrent at constant speed	OC3
0005	Overvoltage during acceleration	OU1
0006	Overvoltage during deceleration	OU2
0007	Overvoltage at constant speed	OU3
0008	Control power supply fault	POF
0009	Undervoltage	LU
000A	AC drive overload	OL2
000B	Motor overload	OL1
000C	Reserved	—
000D	Output phase loss	LO
000E	Module overheat	OH

Code	Fault	Display
000F	External equipment fault	EF
0010	Communication fault	CE
0011	Contactor fault	RAY
0012	Current detection fault	IE
0013	Motor auto-tuning fault	TE
0014	Reserved	—
0015	EEPROM read/write fault	EEP
0016	AC drive hardware fault	OUOC
0017	Motor short circuit to ground	GND
0018	Reserved	—
0019	Reserved	—
001A	Accumulative running time reached	END1
001B	Reserved	—
001C	Reserved	—
001D	Accumulative power-on time reached	END2
001E	Load becoming 0	LOAD
001F	PID feedback lost during running	PIDE
0028	Pulse-by-pulse current limit timeout	CBC
0029	Motor switchover during running	—
002A	Speed deviation too large	ESP
002B	Motor overspeed	OSP
002D	Motor overtemperature	OH2
005A	Encoder pulses per revolution set incorrectly	—
005B	Encoder not connected	—
005C	Initial position fault	—
005E	Speed feedback fault	—

Communication faults (address 8001H)

Code	Description
0000	No fault
0001	Password error
0002	Command code error
0003	CRC check error
0004	Invalid address
0005	Invalid parameter
0006	Parameter change invalid
0007	System locked
0008	EEPROM operation in progress

A.9 Communication Parameters (Group PD)

The communication parameters are set in group PD (detailed description see chapter 6.13).

Parameter	Name	Default
PD.00	Baud rate (unit's digit MODBUS: 5 = 9600 bps)	5005
PD.01	Data format (3 = no parity, 8-N-1)	3
PD.02	Local address (1–247, 0 = broadcast address)	1
PD.03	Response delay	2 ms
PD.04	Communication timeout (0.0 s = disabled)	0.0 s
PD.05	Data transfer format (1 = standard MODBUS protocol)	1
PD.06	Current resolution when reading (0 = 0.01 A)	0

The baud rate and data format of the master and the AC drive must match, otherwise communication is not possible. The higher the baud rate, the faster the communication.
Response delay (PD.03): time between the end of data reception in the AC drive and sending the response to the master. If the response delay is shorter than the system processing time, the processing time applies. If it is longer, the system waits after processing until the response delay has elapsed before sending the response.
Communication timeout (PD.04): with 0.0 s, monitoring is disabled. With a valid value, the AC drive reports a communication fault (CE) if the interval between two messages exceeds this time. Monitoring is normally disabled; in systems with continuous communication, it can be used to monitor the communication status.
PD.05 = 1: standard Modbus protocol. PD.05 = 0: when reading, the slave returns one byte more than with the standard Modbus protocol (number of bytes as two bytes, see example in chapter A.5).