

IRONHORSE®

ACN AC DRIVE

This quick start reference is included in the VFD packaging and is meant to be a supplement to the User Manual, which is available for free download at [Automationdirect.com](https://www.automationdirect.com). This reference informs the installer of the proper steps for mounting, wiring, and basic programming/operation of the ACN VFD up to 22kW/30HP.



CAUTION: IMPROPER WIRING AND OPERATION MAY RESULT IN SERIOUS PERSONAL INJURY OR DEATH

Follow the recommended wiring practices suggested in this document as well as the User Manual. The minimum size of the protective earth (ground) conductor shall comply with local safety regulations and applicable codes.

Please review all ACN related documents included with the product before proceeding with any installation and wiring.

STEP 1 – ACN MODEL NUMBER AND MOUNTING

MODEL NUMBER

Verify that you have the appropriate VFD by checking the namplate information. Utilize the example name plate below to assist you with this.

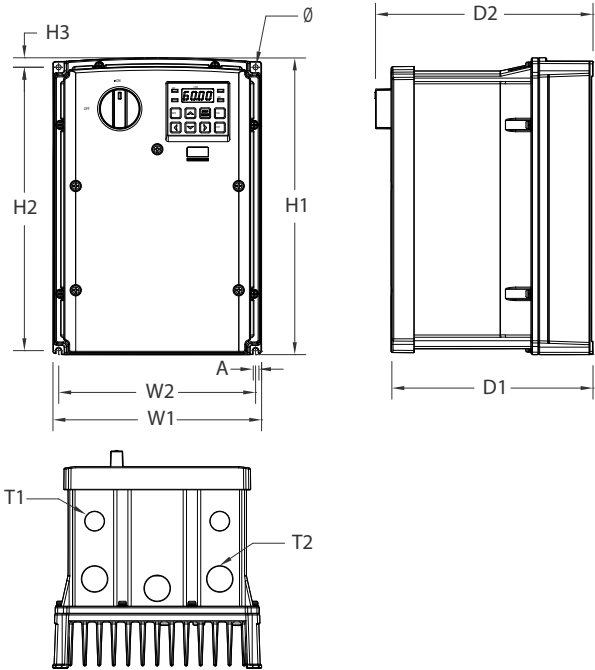
MODEL : ACN-2020

INPUT: 3PH 200-240V 50/60Hz 66.7A
SHORT CIRCUIT CURRENT: 100KA
OUTPUT: 3PH 200-240V 60.0A 22.9kVA 15.0kW/20.0 HP
FREQUENCY RANGE : 0-400Hz

QR Code



DIMENSIONS



NOTE: Drive diagram (Frame1) is a reference for dimensions chart. See manual for specific Drive Frame diagrams as they differ slightly

NOTE: Verify that the input voltage rating matches the voltage source which will be applied to the VFD.

NOTE: Confirm that the output power of the VFD is equal to or greater than the rating of the motor which will be connected. Ratings for Single phase input power can be found in the manual.

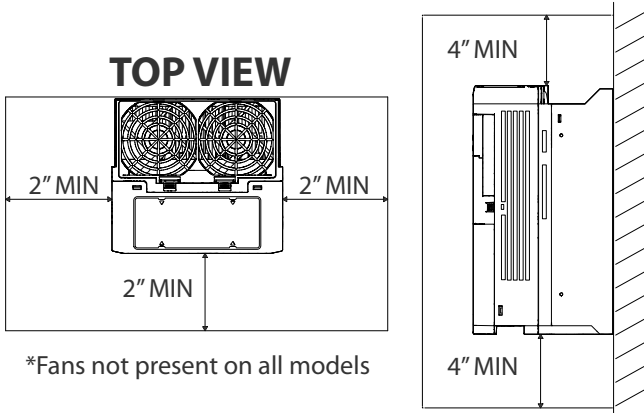
Dimensions												
Frame	Part no	W1	W2	H1	H2	H3	D1	D2	A	Ø	T1	T2
1	ACN(ND)-20P5	180 (7.09)	170 (6.69)	256.6 (1010)	245 (9.65)	8.2 (0.32)	174.2 (6.86)	188.2 (7.41)	4.5 (0.18)	4.5 (0.18)	22.3 (0.88)	-
	ACN(ND)-21P0											
	ACN(ND)-40P5											
	ACN(ND)-41P0											
2	ACN(ND)-22P0	220 (8.66)	204 (8.03)	258.8 (10.19)	241 (9.49)	11.8 (0.46)	201 (7.91)	215 (8.46)	5.5 (0.22)	5.5 (0.22)	22.3 (0.88)	28.6 (1.13)
	ACN(ND)-23P0											
	ACN(ND)-25P0											
	ACN(ND)-42P0											
	ACN(ND)-43P0											
3	ACN(ND)-27P5	250 (9.84)	232 (9.13)	328 (12.91)	308 (12.13)	11 (0.43)	227.2 (8.94)	241.2 (9.50)	6 (0.24)	6 (0.24)	22.3 (0.88)	28.6 (1.13)
	ACN(ND)-2010											
	ACN(ND)-47P5											
	ACN(ND)-4010											
4	ACN(ND)-2015	260 (10.24)	229 (9.02)	399.6 (15.73)	377 (14.84)	14.6 (0.57)	245.4 (9.66)	259.6 (10.22)	6 (0.24)	-	22.3 (0.88)	34.9 (1.37)
	ACN(ND)-4015											
	ACN(ND)-4020											
5	ACN(ND)-2020	300 (11.81)	270.8 (10.66)	460 (18.11)	436.5 (17.19)	15.5 (0.61)	250 (9.84)	264 (10.39)	6 (0.24)	-	22.3 (0.88)	44.5 (1.75)
	ACN(ND)-4025											
	ACN(ND)-4030											

Units: mm (in)

MOUNTING

When selecting an installation location consider the following points:

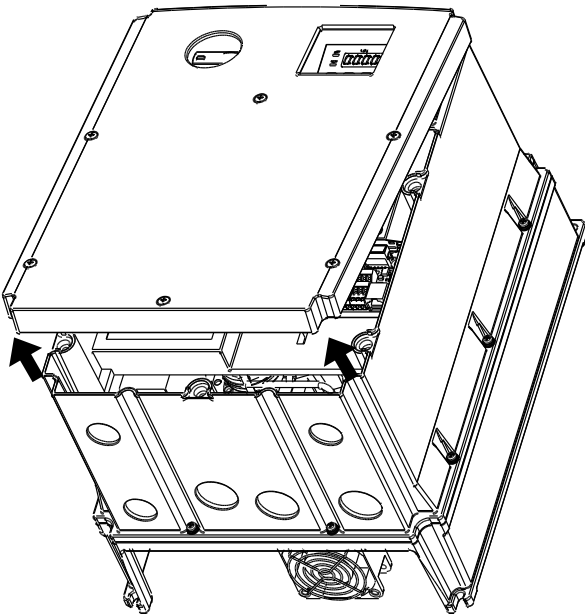
- The drive must be installed on a wall or panel that can support the drive's weight.
- The location must be free from vibration. Vibration can adversely affect the operation of the drive.
- The drive can become very hot during operation. Install the drive on a surface that is fire-resistant or flame-retardant and with sufficient clearance around the drive to allow air to circulate. The illustrations below detail the required minimum installation clearances.



*Fans not present on all models

COVER REMOVAL

After mounting, fully loosen all screws from the cover and lift from the bottom.



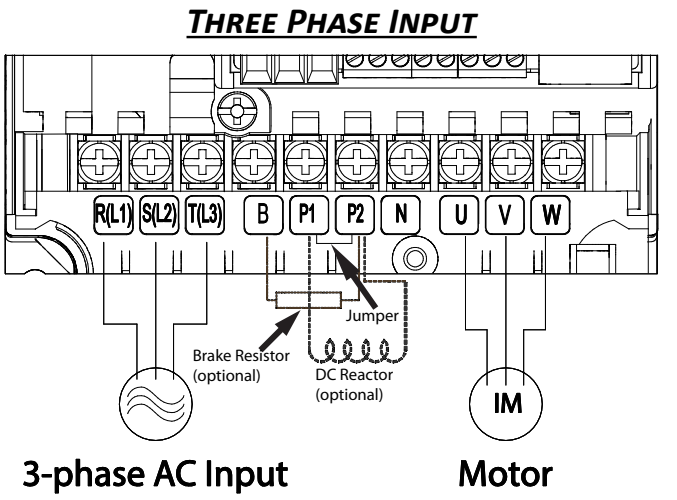
STEP 2 – CONNECT LINE AND MOTOR POWER

Utilize the below wiring diagrams to properly wire the main power connections to the VFD. This step should be done with power OFF! Refer to the User Manual for additional wire recommendations. Be sure to follow good wiring and grounding practices. Follow applicable local codes if needed.



DANGER: LETHAL VOLTAGES ARE PRESENT. BE SURE THAT ALL POWER IS TURNED OFF WHILE PERFORMING THE RECOMMENDED POWER WIRING. REINSTALL ALL PROTECTIVE COVERS ON THE ACN BEFORE REAPPLYING POWER

Proper wiring for 3-Phase applications is shown below. The physical terminal layout varies according to frame size. Terminal names (e.g. R, S, T, etc) will remain consistent.



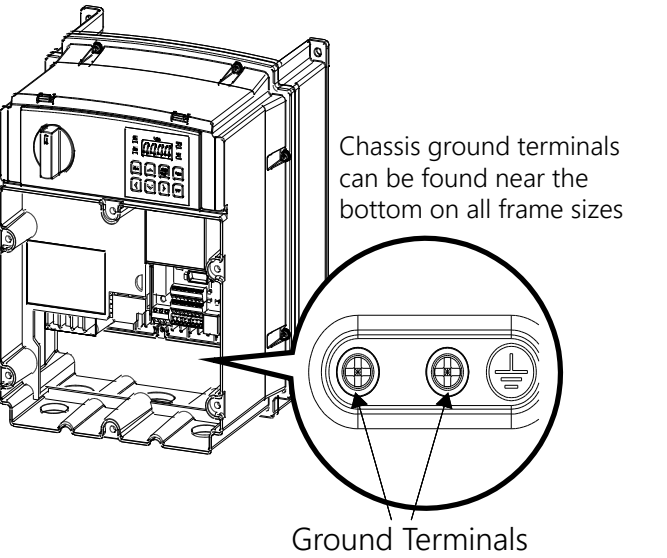
- 
- NOTE:** For single phase input, use R&T terminals only.

B, P1,P2 and N terminals should not be connected to power or ground.

Remove P1-P2 jumper before connecting a DC reactor.

Power Terminals Wire Size and Torque				
Part Number	Power Terminal Screw Size	Screw Torque (Nm)	Recommended Wire size AWG (mm2)	
			Power R,S,T ; U,V,W	Ground
ACN(ND)-20P5	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-21P0	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-22P0	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-23P0	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-25P0	M4	0.2-0.6	12 (3.5)	12 (4)
ACN(ND)-27P5	M4	0.2-0.6	10 (6)	10 (5.5)
ACN(ND)-2010	M4	0.2-0.6	10 (6)	10 (5.5)
ACN(ND)-2015	M5	0.4-1.0	6 (16)	6 (14)
ACN(ND)-2020	M5	0.4-1.0	6 (16)	6 (14)
ACN(ND)-40P5	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-41P0	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-42P0	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-43P0	M3.5	0.2-0.6	14 (2)	12 (4)
ACN(ND)-45P0	M4	0.2-0.6	14 (2)	12 (4)
ACN(ND)-47P5	M4	0.2-0.6	14 (2.5)	12 (4)
ACN(ND)-4010	M4	0.2-0.6	12 (4)	12 (4)
ACN(ND)-4015	M5	0.4-1.0	12 (4)	8 (8)
ACN(ND)-4020	M5	0.4-1.0	10 (6)	8 (8)
ACN(ND)-4025	M5	0.4-1.0	8 (10)	6 (14)
ACN(ND)-4030	M5	0.4-1.0	8 (10)	6 (14)

Use copper wires with 600V, 75°C for power terminal wiring.



STEP 3 – KEYPAD NAVIGATION AND PARAMETER CHANGES

OPERATION GROUP

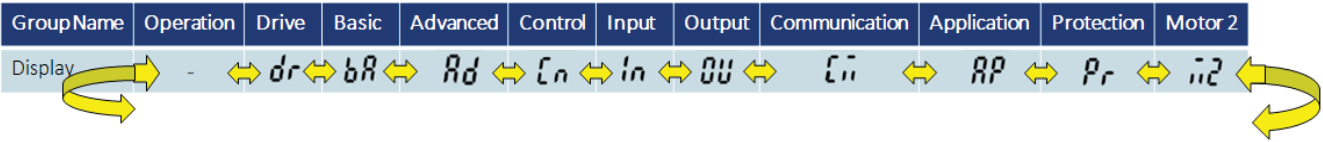
From the main screen (0.00), the UP and DOWN arrows will navigate through the Operation group. The Operation group contains many basic start up parameters for control and monitoring. See the list of Operation group parameters below.

Display	Operation Group
0.00	Command Frequency
drC	Rotation Direction Select
nOn	Reserved
vOL	Output Voltage
dCL	DC Voltage
rPm	Motor RPM
CUr	Output Current
St3	Multi-Step Frequency 3
St2	Multi-Step Frequency 2
St1	Multi-Step Frequency 1
Fr9	Frequency Source Reference
drv	Command Source
dEC	Deceleration Time 1
ACC	Acceleration Time 1

PARAMETER GROUPS

Pressing the LEFT or RIGHT arrows will move through the different parameter groups. While the UP and DOWN arrows will navigate through the different parameter code #'s in the selected group.

Display	Parameter Group
dr	Drive
bA	Basic
Ad	Expanded
Cn	Control
In	Input Terminal Block
OU	Output Terminal Block
CM	Communication
AP	Application
AO	Optional I/O Card (ACN-EIO card is installed)
Pr	Protection
M2	2nd Motor (In.65-69-> any one of these parameters is set to 26)
US	User Sequence (AP.02 =1 or CM.95=1)
UF	User Sequence Function (AP.02 =1 or CM.95=1)



Any of the above parameters and monitors settings can be accessed by pressing the ENT key. Pressing the ENT key again, or the ESC key will go back to the previous display.

CHANGING ACCELERATION TIME EXAMPLE

- 
- 1) Press UP arrow from the main display (0.00) until ACC is displayed.
 - 2) Press ENT key one time to display the present value.
 - 3) Use the UP and DOWN arrows to increase and decrease the value.
 - 4) Use the LEFT or RIGHT arrows to move the cursor over to select different digits.
 - 5) Press the ENT key TWO TIMES once the desired value is set. This saves the change.
 - 6) ACC will be displayed again indicating the parameter change has taken effect.



NOTE: Press the ENT key TWO times to save parameter changes!

STEP 4 – CONNECT CONTROL WIRING

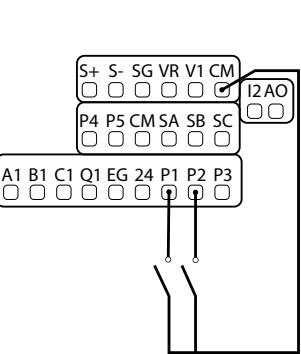
CONTROL WIRE SIZE

Terminal	Terminal Screw Size	Screw Torque (Nm)	Wire Size AWG (mm2) Bare Wire	Wire Size AWG (mm2) with Bootlace Ferrule
P1-P5/ CM/VR/ V1/I2/AO/ Q1/EG/24/ SA,SB,SC/ S+,S-,SG	M2	0.22-0.25	18 (0.75)	20 (0.5)
A1/B1/C1	M2.6	0.4	17 (1.0)	15 (1.5)

**see manual for crimp terminal cable size and detail*

RUN COMMAND WIRING

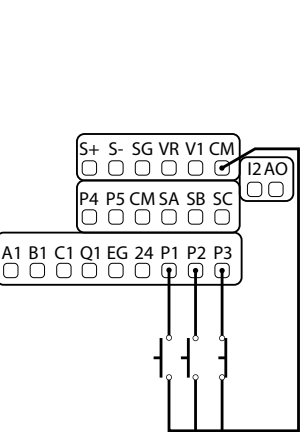
2-Wire Control



2-wire control consists of maintained run signals. This can be accomplished via toggle switches, relays, jumpers, etc. Default parameters support this operation.

P1=Forward Run (Fx)
P2=Reverse Run (Rx)
CM=Common

3-Wire Control

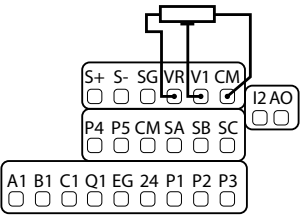


3-Wire control consists of momentary push buttons to run and stop the VFD. The Forward and Reverse buttons are Normally Open while the Stop button is Normally Closed. Set parameter In.67=14 if using P3 (like below) for the Stop button.

P1 = Forward Run (Fx)
P2 = Reverse Run (Rx)
P3 = Stop (3-Wire)
CM = CommonFrequency Reference Wiring

FREQUENCY REFERENCE WIRING

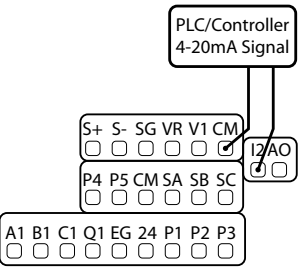
Speed Pot Wiring (0-10VDC)



Controlling the VFD with an external speed POT can be accomplished by setting Operation Menu parameter Fr9=2 and wiring according to the example below. For 0-10VDC signals from a PLC or Controller simply wire to V1 and CM.

VR = 10VDC
V1 = Wiper
CM = Common

PLC or Controller Wiring (4-20mA)



For speed control with a 4-20mA signal, set Operation Menu parameter Fr9=5.

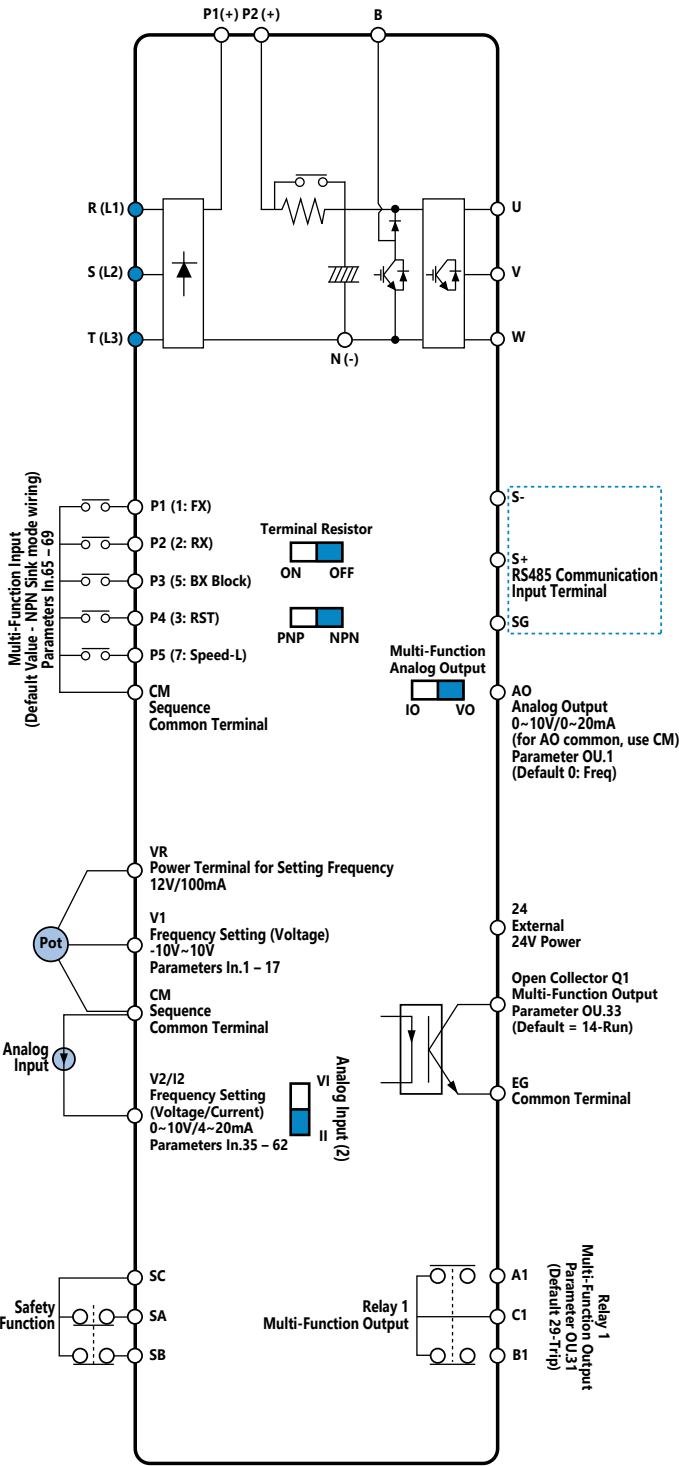
I2 = + Signal
CM = - Common

NOTE: Verify that SW2 dip switch on the terminal board to 'II' (down) for 4-20mA signal.



We strongly recommend that customers use the STO safety feature. The Safe Torque Off (STO) function turns off the power supplied to the motor through the hardware, so that the motor cannot produce torque. This method of removing power from the motor is considered an emergency stop, also known as "coast to stop." To use this feature, disconnect the appropriate factory-installed jumpers and wire a safety relay, safety PLC, or E-Stop pushbutton as shown. Use terminals SA,SB,SC shown in control wiring diagram

IO WIRING



NOTE: Default is marked in blue.

STEP 5 – BASIC SETUP PARAMETERS

REQUIRED MOTOR PARAMETERS

Set these motor parameters based on the nameplate.

Group	No	Description	Default	Set Options
dr	14	Motor Capacity	Model Dependent	Model Dependent
bA	11	Poles	4	2-12
bA	13	Motor Rated Current	Model Dependent	Model Dependent
bA	15	Motor Voltage	Model Dependent	Model Dependent

dr.14: HP to kW Conversion Chart (Parameter in kW)

HP	kW
1/4	0.2
1/2	0.4
1	0.75
1.5	1.1
2	1.5
3	2.2
5	3.7
7	5.5
10	7.5
15	11
20	15
25	18.5
30	22
40	30
50	37
60	45
75	55
100	75

Motor RPM to Poles Chart

RPM	3600	1800	1200
Poles	2	4	6

EXAMPLE: If actual motor RPM is 3450. Set Motor Poles = 2. This is due to motor slip. In this example, the motor has 150 RPM of slip. (Slip=Synchronous speed - Rated Speed)

OPTIONAL PARAMETERS

- To automatically start after a power loss, set Ad.10=1. To enable power-on run, set the Operation Group drv parameter to Fx/Rx-1 or Fx/Rx-2. Run signal must stay present on power up.
- Enable phase loss protection by setting the virtual dipswitches in Pr.5 both to the up (top) position.
- Enable auto restart after a fault trip by setting the below...
 - » Pr.8 = 1
 - » Pr.9 = # of retry attempts

STEP 5 – BASIC SETUP PARAMETERS (CONT'D)

FAULT CODES

Keypad Display	LCD Display	Description
olt	Over Load	Motor overload trip. Operates when Pr.20 > 0
ult	Under Load	Motor under-load trip. Operates when Pr.27 >0
oct	Over Current 1	Drive output current exceeds 200% of rated current
ovt	Over Voltage	Internal DC voltage exceeds the specified value
lvt	Low Voltage	Internal DC circuit voltage less than the limit
lv2	Low Voltage2	Internal DC circuit voltage less than limit during operation
gft	Ground Trip*	Grnd Flt trip occurs on drive output side and causes the current to exceed limit
eth	E-Thermal	Thermal load calculation determines motor overheating. Operates when Pr.40 >0
pot	Out Phase Open	Drive output phase(s) in open circuit condition. Operates when Pr.05 Bit 1=1
ipo	In Phase Open	3-ph drive input phase(s) in an open circuit condition. Operates when Pr.05 bit2=1
iol	Drive OLT	Overload and resultant overheating based on thermal limits
nmt	No Motor Trip	Motor is not connected during drive operation. Operates when Pr.31=1
oht	Over Heat	Drive heat sink temperature exceeds limit
oc2	Over Current2	DC circuit detection of excessive, short circuit current
ext	External Trip	External fault input signal is ON. Operates when In.65-69=4
bx	BX	Bx input signal is ON. Operates when In.65-69=5
hwt	H/W-Diag	Memory error detected (EEPROM)
ntc	NTC Open	Insulated Gate Bipolar Transistor (IGBT) Temperature sensor error
fan	Fan Trip	Cooling Fan malfunction. Operates when Pr.79 =0
pid	Pre-PID Fail	Pre-PID is operating and controlled variable PID feedback < set value
xbr	Ext-Brake	External Brake output signal is ON & VFD output current <Ad.41.Operates when OU.31/32= 35
sfa sfb	Safety A(B) Err	Either safety input signal is off
lcr	Lost Command	Frequency or operation command error detected during drive operation Operates when Pr.12>0
iot hold errc	IO Board Trip	I/O board, communication card malfunction
		Error code continues for more than 5 sec
par		Communication fails during parameter writing with LCD keypad(ACN-LCD)
opt	Option Trip-1	Comm error is detected between the drive and the comm board. Operates when ACN-ETH is installed

ACN drives rated for 4.0kW or less do not support the ground fault trip (GFT) feature. Therefore, an over current trip (OCT) or over voltage trip (OVT) may occur when there is a low-resistance ground fault.

COMMONLY SET PARAMETERS

Pr.Code	Parameter Name	Setting Range	Units	Initial Value
Op Menu: 0.00	Command Frequency	Start Freq(dr.19) - Max Freq(dr.20)	Hz	0
Op Menu: ACC	Acceleration Time	0.0 - 600.0	sec	20.0
Op Menu: dEC	Deceleration Time	0.0 - 600.0	sec	30.0
Op Menu: drV	Command Source	0 : Keypad 1: Fx/Rx -1 (Fwd/Rev Run) 2: Fx/Rx -2 (Run/Dir) 3: Int 485 4: Field Bus 5: UserSeqLink	-	1- Fx/Rx -1
Op Menu: Fr9	Frequency Source Reference	0 :Keypad-1 1 :Keypad-2 2 :V1 4 :V2 5 :I2 6 :Int 485 8 :Field Bus 9 :UserSeqLink 12 :Pulse 13 :V3 15 :V4 16 :I4	-	0 Keypad-1
dr.9	Control Mode	0 :V/F 2 :Slip Compensation 4 :IM Sensorless 6 :PM Sensorless	-	0 V/F
dr.11	JOG Frequency	0.00, Start frequency-Maximum frequency	Hz	10.00
dr.12	Jog Run Acceleration Time	0.0 - 600.0	sec	20.0
dr.13	JOG Dec Time	0.0 - 600.0	sec	30.0
dr.18	Base Frequency	30.00 - 400.00	Hz	60.0
dr.19	Start Frequency	0.01 - 10.00	Hz	0.50
dr.20	Maximum Frequency	40.00~400.00(Hz) [V/F, SlipCompen] 40.00~120.00(Hz) [IMSensorless] 40.00~180.00(Hz) [PMSensorless]	Hz	60.0
dr.93	Parameter Initialize (Reset to Defaults)	0 : No 1: All Groups 2: dR group 3: bA group 4: Ad group 5: Cn group 6: In group 7: OU group 8: CM group 9: AP group 12: Pr group 13: M2 group 14: US group 15: UF group 16: SPS group	-	0
bA.19	AC Input Volt	170 - 480	v	220 / 480
Ad.9	Rotation Direction	0 : None 1 : Forward Prevent 2 : Reverse Prevent	-	0: None
In.1	Max Analog input Freq	Start freq [dr.19] - Max freq [dr.20] (Hz)	Hz	Max Freq
In.65	P1 Define	See Multifunction Discrete Input Selection Chart	-	1: Fx
In.66	P2 Define		-	2: Rx
In.67	P3 Define		-	3: Bx
In.68	P4 Define		-	4: Rst
In.69	P5 Define		-	5: Speed-L
OU.31	Relay 1 (A1/B1/C1)	See Multifunction Discrete Output Selection Chart	-	29: Trip
OU.33	Q1 Define		-	14: Run
OU.1	Analog output 1	See Analog Output (AO) Selection Chart	-	0: Freq
Pr.21	OL Trip Level	30 - 180	%	180
Pr.22	OL Trip Time	0 - 60.0	sec	60

MULTIFUNCTION INPUT/OUTPUT SELECTION CHARTS

Multi-Function P1-P5 Discrete Input Selections	Multi-Function R1/Q1 Discrete Output Selections	Multi-Function AO Selections
0 : None	0 : None	0 : Frequency
1 : Fx	1 : FDT-1	1 : Output Current
2 : Rx	2 : FDT-2	2 : Output Voltage
3 : Reset	3 : FDT-3	3 : DCLink Voltage
4 : Ext Trip	4 : FDT-4	4 : Torque
5 : BX (Block)	5 : Over Load	5 : Output Power
6 : JOG	6 : IOL	6 : Idse
7 : SpdL	7 : Under Load	7 : Iqse
8 : SpdM	8 : Dan Warning	8 : Target Freq
9 : SpdH	9 : Stall	9 : Ramp Freq
11 : XcelL	10 : Over Voltage	10 : Speed Fdb
12 : XcelM	11 : Low Voltage	12 : PID Ref Value
13 : RUN Enable	12 : Over Heat	13 : PID Fdb Value
14 : 3-wire	13 : Lost Command	14 : PID Output
15 : 2nd Source	14 : Run	15 : Constant
16 : Exchange PWR	15 : Stop	
17 : Spd Up	16 : Steady	
18 : Spd Down	17 : Inverter Line	
20 U/D clear	18 : Comm Line	
21 : Analog Hold	19 : Speed Search	
22 I Term Clear	22 : Ready	
23 : PID openloop	28 : Timer Out	
24 : P Gain2	29 : Trip	
25 : Xcel Stop	31 : DB Warn%ED	
26 : 2nd Motor	34 : On/Off Control	
34 : Pre Excite	35 : BR Control	
38 : Timer in	38 : Fire Mode	
40 : Dis Aux Ref	39 : TO (Q1 Only)	
46 : FWD JOG	40 : KEB Operation	
47 : REV JOG		
49 : Xcel-H		
50 : User Seq		
51 : Fire Mode		
52 : KEB-1 Select		
54 : TI (P5 only)		