IronHorse ACN Series Introduction

IronHorse ACN NEMA 4X Drives												
Motor Rating	HP	0.5	1.0	2.0	3.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0
	kW	0.4	0.8	1.5	2.2	4.0	5.5	7.5	11.0	15.0	18.5	22.0
230V Single-Phase Input/ 230V Three-Phase Output		✓	✓	✓	✓	✓	✓	✓				
230V Three-Phase Input/ 230V Three-Phase Output		✓	✓	✓	✓	✓	✓	✓	✓	✓		
460V Single-Phase Input/ 460V Three-Phase Output		✓	✓	✓	✓	✓	✓	✓	✓	✓		
460V Three-Phase Input/ 460V Three-Phase Output		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Overview

The Ironhorse ACN sensorless, vector control drives provide many standard and advanced functions in a serviceable NEMA 4X unit, allowing installation in the harshest of environments. The drives include many of the same standard features as our DURAPulse family of drives including dynamic braking, PID, and RS-485 Modbus communication. All 230VAC and 460VAC drives are fully capable of single-phase input capability (with de-rating) and optional EtherNet/IP and Modbus TCP communication card. The drive supports up to two (2) independent IM motor parameter sets or supports control of a single Permanent Magnet AC (PMAC) motor. Ironhorse ACN AC drives offer several different control modes: standard V/Hz, sensorless vector, and torque control. Ironhorse ACN provides two analog inputs, one analog output, one frequency output, five digital inputs (including one pulse train input up to 32kHz), one digital output, one SPDT relay output, and a 2 channel STO input. All of the analog and digital I/O can be configured for a wide variety of input or output functions. One option card slot is available for either the Extension IO option card or Ethernet/IP and Modbus TCP communication option card

Features

- Broad offering from 1/2 to 30 hp NEMA 4X
- 230VAC: three-phase up to 20Hp, single phase up to 10hp
- 460VAC: three phase up to 30HP, single-phase up to 15hp
- Single-phase UL Ratings – 230 or 460 VAC input
- Lockable, integrated disconnect or no disconnect models
- Constant Torque (Heavy Duty) ratings only
- Flexible carrier frequency to 15khz
- Output frequency to 400Hz (120Hz sensorless vector)
- STO – Safe Torque Off (SIL2))
- Built in user sequence programming of 18 steps.
- Built-in RJ45 port for fast & easy programming.
- Free downloadable software for drive configuration
- Optional LCD text-based advanced
- Keypad can be remotely mounted with IP66 case.
- Local/Remote control mode selection or digital/comm input with Hand/Off/Auto control
- Momentary power loss restarts
- PCB Conformal Coating
- 100kA Short Circuit Current Rating
- DC Bus Connection Terminals
- Analog I/O – configurable 2 Inputs and 1 Output
- 2-Motor Control
- Built-in Dynamic Braking – optional resistors
- PID Controller – including sleep and wake
- Password protection
- RTD and/or PTC input motor protection
- High speed communication interfaces with MODBUS RTU built in, with optional EtherNet/IP and ModbusTCP Communication Card
- Able to operate at 40°C ambient temperature
- Fire Mode – Run fire mode during emergencies to have uninterrupted smoke removal and system pressure
- 18 month warranty
- CE, TÜV Nord (SIL2), UL, cUL

Accessories

- AC line reactors
- dV/dT output filters
- EMI filters
- RF filter
- Braking resistors
- Fuses
- Optional advanced LCD keypad
- Remote Keypad Mounting Kits
- EtherNet/IP and ModbusTCP comm card
- Extension IO card
- VFD Suite drive configuration software
- Type A USB to RJ45 programming cable

Typical Applications

- Conveyors
- Fans
- Pumps
- Shop tools
- Mixer
- Crane and Hoist
- Press
- Auger
- Centrifuge
- Waste Water Rake Drive
- X-Y Positioning
- Vibratory Tables
- Synchronous Machine

Selecting the Proper Drive Rating

Selecting the Proper Drive Rating

Determine Motor Voltage and Full-Load Amperage (FLA)

Motor voltage and FLA are located on the nameplate of the motor.
NOTE: FLA of motors that have been rewound may be higher than stated.

Determine Motor Overload Requirements

Many applications experience temporary overload conditions due to starting requirements or impact loading. Most AC drives are designed to operate at 150% overload for 60 seconds. If the application requires an overload greater than 150% or longer than 60 seconds, the AC drive must be oversized.
NOTE: Applications that require replacement of existing motor starters with AC drives may require up to 600% overload.

Determine Application Type: Constant Torque or Variable Torque

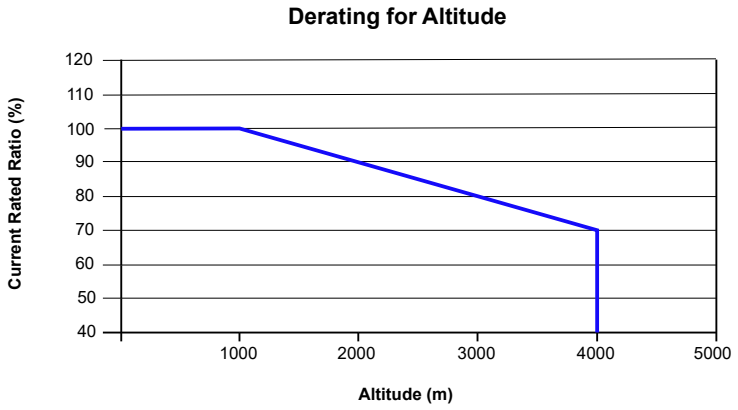
This torque requirement has a direct effect on which drive to select. Variable Torque applications are generally easier to start; typically fans and pumps. Most other applications outside fans and pumps fall into the Constant Torque category (machine control, conveyors, etc.). If you are unsure of the application, assume Constant Torque.
ACN drives are specified with constant torque ratings only.

Installation Altitude

AC drives rely on air flow for cooling. ACN drives are designed to operate at 100% capacity at altitudes up to 1000 meters. As the altitude increases, the air becomes less dense. This drop in air density decreases the cooling properties of the air, therefore, the AC drive must be oversized to compensate for the decrease in cooling.
NOTE: For use above 1000m, the AC drive must be derated as described below.

Derate Output Current Based on Altitude Above 1000 Meters

- If the AC drive is installed at an altitude of 0–1000m, follow normal operation restrictions.
- From 1000 to 4000m, the rated input voltage and rated output current of the drive must be derated by 1% for every 100m.



Selecting the Proper Drive Rating

Derate Output Current Based on Carrier Frequency (if necessary)

Carrier Frequency Effects

AC Drives rectify the incoming 50Hz or 60Hz line power resulting in DC power. The DC power is then pulse-width modulated and supplied to the motor by the drive's power electronics. IGBTs invert the DC power, simulating a sine wave at the desired frequency (that's what allows variable speed in AC induction motors). The speed at which the IGBTs are turned ON and OFF is called Carrier Frequency. In ACN drives, the Carrier Frequency can range from 2kHz to 15kHz. Though Carrier Frequency can be adjusted, there are trade-offs between high Carrier Frequencies and low Carrier Frequencies.

Benefits of Higher Carrier Frequencies:

- Better efficiency (lower harmonic losses) in the motor
- Lower audible noise

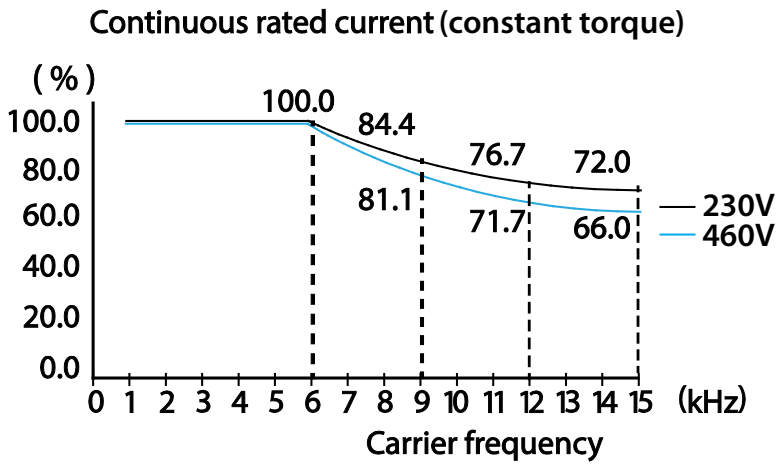
Benefits of Lower Carrier Frequencies:

- Better efficiency in the drive
- Lower EMI (electrical noise)
- Reduced reflective wave peak voltage

As a general rule, the Carrier Frequency should be set as low as possible without creating unacceptable audible noise in the motor. Smaller systems can have higher Carrier Frequencies, but larger drives (>20 or 30hp) should not have Carrier Frequencies set higher than 6kHz. Heavy duty applications typically run around 2–4 kHz.

Derating Tables

230V		***460V***	
Carrier Frequency (kHz)	***Constant Rated Current (%)***	***Carrier Frequency (kHz)***	***Constant Rated Current (%)***
1-6	100	1-6	100
9	84.4	9	81.1
12	76.7	12	71.7
15	72.0	15	66.0



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IronHorse ACN Series Selection Specifications

ACN 230V Class Constant Torque Specifications; Frame Sizes 1–5																			
Part Number		ACN-20P5	ACNND-20P5	ACN-21P0	ACNND-21P0	ACN-22P0	ACNND-22P0	ACN-23P0	ACNND-23P0	ACN-25P0	ACNND-25P0	ACN-27P5	ACNND-27P5	ACN-2010	ACNND-2010	ACN-2015	ACNND-2015	ACN-2020	ACNND-2020
Price		$376.00	$242.00	$382.00	$246.00	$490.00	$316.00	$521.00	$336.00	$639.00	$451.00	$912.00	$618.00	$1,017.00	$690.00	$1,258.00	$852.00	$1,432.00	$970.00
Frame Size		1				2						3				4		5	
Applied Motor	**Max Motor Output (3-phase [1-phase])**	1/2hp [1/6hp]		1hp [1/2hp]		2hp [1hp]		3hp [1-1/2hp]		5hp [2hp]		7-1/2hp [3hp]		10hp [5hp]		15hp [7-1/2hp]		20hp [10hp]	
		0.4kW [0.1kW]		0.8kW [0.4kW]		1.5kW [0.8kW]		2.3kW [1.1kW]		4.0kW [1.5kW]		5.6kW [2.3kW]		7.5kW [3.8kW]		11.2kW [5.6kW]		15.0kW [7.5kW]	
Output Rating	**Rated Capacity–3ph input (kVA)**	1.0		1.9		3.0		4.2		6.5		9.1		12.2		17.5		22.9	
	Rated Current (3-phase [1-phase])	2.5A [1.5A]		5A [2.8A]		8A [4.6A]		11A [6.1A]		17A [9.3A]		24A [13A]		32A [18A]		46A [26A]		60A [33A]	
	Output Frequency	0.1-400 Hz (IM Sensorless: 0-120 Hz)																	
	Output Voltage	3-phase 200-240 VAC																	
Input Rating	**Working Voltage–3ph input**	3-phase 200-240 VAC (-15% to +10%)																	
	Working Voltage–1ph input	1-phase 240VAC (-5% to +10%)																	
	Input Frequency–3ph input	50-60 Hz (±5%)																	
	Input Frequency–1ph input	60Hz (±5%)																	
	Rated Current–1 or 3ph input (A)	2.2		4.9		8.4		11.8		18.5		25.8		34.9		50.8		66.7	
Weight (lb)		7.9		7.9		11.5		11.9		12.13		19.4		19.4		20.7		26.2	
Cooling Method		Forced Fan–Internal										Forced Fan–Internal & Single External				Forced Fan-Internal & Dual External			
Drawing Link		PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF

- **All specifications are for Constant Torque duty.**
- **The standard motor capacity is based on a standard 4-pole motor.**
- **The standard used for 230V series drives is based on a 220V supply voltage.**
- **The rated output current is limited based on the carrier frequency set at Cn.04.**
- **The output voltage becomes 20~40% lower during no-load operations to protect the drive from the impact of the motor closing and opening (0.5~5 hp models only).**

ACN-20P5
(with disconnect)

ACNND-20P5
(without disconnect)

IronHorse ACN Series Selection Specifications

ACN 460V Class Constant Torque Specifications; Frame Sizes 1–3															
Part Number		ACN-40P5	ACNND-40P5	ACN-41P0	ACNND-41P0	ACN-42P0	ACNND-42P0	ACN-43P0	ACNND-43P0	ACN-45P0	ACNND-45P0	ACN-47P5	ACNND-47P5	ACN-4010	ACNND-4010
Price		$458.00	$296.00	$467.00	$304.00	$502.00	$325.00	$570.00	$402.00	$996.00	$527.00	$1,117.00	$688.00	$1,239.00	$762.00
Frame Size		1				2						3			
Applied Motor	**Max Motor Output (3-phase [1-phase])**	1/2hp [1/6hp]		1hp [1/2hp]		2hp [3/4hp]		3hp [1hp]		5hp [2hp]		7-1/2hp [3hp]		10hp [5hp]	
		0.4kW [0.1kW]		0.8kW [0.4kW]		1.5kW [0.6kW]		2.3kW [0.8kW]		4.0kW [1.5kW]		5.5kW [2.3kW]		7.5kW [3.8kW]	
Output Rating	**Rated Capacity–3ph input (kVA)**	1.0		1.9		3.0		4.2		6.5		9.1		12.2	
	Rated Current (3-phase [1-phase])	1.3A [0.8A]		2.5A [1.5A]		4A [2.3A]		5.5A [3.1A]		9A [5.4A]		12A [7.1A]		16A [9.5A]	
	Output Frequency	0.1-400 Hz (IM Sensorless: 0-120 Hz)													
	Output Voltage	3-phase 380-480 VAC													
Input Rating	**Working Voltage–3ph input**	3-phase 380-480 VAC (-15% to +10%)													
	Working Voltage–1ph input	1-phase 480VAC (-5% to +10%)													
	Input Frequency–3ph input	50-60 Hz (±5%)													
	Input Frequency–1ph input	60Hz (±5%)													
	Rated Current–1 or 3ph input (A)	1.1		2.4		4.2		5.9		9.8		12.9		17.5	
Weight (lb)		7.9		7.9		11.5		11.9		12.13		18.9		19.2	
Cooling Method		Forced Fan–Internal										Forced Fan–Internal & SingleExternal			
Drawing Link		PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF

- All specifications are for Constant Torque duty.
- The standard motor capacity is based on a standard 4-pole motor.
- The standard used for 460V series drives is based on a 440V supply voltage.
- The rated output current is limited based on the carrier frequency set at Cn.04.
- The output voltage becomes 20~40% lower during no-load operations to protect the drive from the impact of the motor closing and opening (0.5~5 hp models only).

ACN-40P5
(with disconnect)

ACNND-40P5
(without disconnect)

IronHorse ACN Series Selection Specifications

ACN 460V Class Constant Torque Specifications; Frame Sizes 4–5									
Part Number		ACN-4015	ACNND-4015	ACN-4020	ACNND-4020	ACN-4025	ACNND-4025	ACN-4030	ACNND-4030
Price		$1,312.00	$807.00	$1,591.00	$979.00	$1,620.00	$997.00	$1,731.00	$1,065.00
Frame Size		4				5			
Applied Motor	Max Motor Output (3-phase [1-phase])	15hp [7-1/2hp]		20hp [10hp]		25hp [10hp]		30hp [15hp]	
		11.0kW [5.6kW]		15.0kW [7.5kW]		18.5kW [7.5kW]		22.0kW [11.2kW]	
Output Rating	Rated Capacity–3ph input (kVA)	18.3		22.9		29.7		34.3	
	Rated Current (3-phase [1-phase])	24A [15A]		30A [18A]		39A [23A]		45A [27A]	
	Output Frequency	0.1-400 Hz (IM Sensorless: 0-120 Hz)							
	Output Voltage	3-phase 380-480 VAC							
Input Rating	Working Voltage–3ph input	3-phase 380-480 VAC (-15% to +10%)							
	Working Voltage–1ph input	1-phase 480VAC (-5% to +10%)							
	Input Frequency–3ph input	50-60 Hz (±5%)							
	Input Frequency–1ph input	60Hz (±5%)							
	Rated Current–1 or 3ph input (A)	26.5		33.4		43.6		50.7	
Weight (lb)		20.7		21.2		26.9		26.9	
Cooling Method		Forced Fan-Internal & Dual External							
Drawing Link		PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF

- All specifications are for Constant Torque duty.
- The standard motor capacity is based on a standard 4-pole motor.
- The standard used for 460V series drives is based on a 440V supply voltage.
- The rated output current is limited based on the carrier frequency set at Cn.04.

ACN-4015
(with disconnect)

ACNND-4015
(without disconnect)

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IronHorse ACN Series General Specifications

ACN General Specifications

IronHorse ACN Series General Specifications (All Models)			
Control Characteristics	*Control Method*	V/F, Slip Compensation, Sensorless Vector (IM or PM), Torque	
	Applicable Motor	AC Induction Motor(IM), AC Permanent Magnet Motor(PM)	
	Frequency Settings Power Resolution	Digital command: 0.01 Hz; Analog command: 0.06 Hz (60Hz standard)	
	Starting Torque	150% / 3Hz (V/F) 150% / 0.1 Hz (IM Sensorless) 100% / 3Hz (PM Sensorless	
	Speed Regulation	± 3% of max freq (V/F) ± 0.3% of max freq (IM Sensorless) ± 1% of max freq (PM Sensorless)	
	Speed Control Range	40:1 (V/F) 100:1 (IM Sensorless) 20:1 (PM Sensorless)	
	Torque Mode Accuracy	± 10%	
	Torque Mode Limits	± 180%	
	V/F Pattern	Linear, square reduction, user V/F	
	Overload Capacity	Constant Torque rated current: 150% for 1 minute; 200% for 4 sec	
	Torque Boost	Manual torque boost, automatic torque boost	
Operation Characteristics	*Operation Command Signal*	Keypad, Digital, Serial Communication	
	Frequency Setting Signal	Analog type: -10~10 V, 0~10 V, 4~20 mA Digital type: keypad, pulse train input Serial Communication	
	Main Functions	PID control 3-wire operation Frequency limit Second function Anti-forward and reverse direction rotation Commercial transition Speed search Power braking Leakage reduction Up-down operation	DC braking Frequency jump Slip compensation Automatic restart Automatic tuning Energy buffering Flux braking Fire mode Programmable User Sequence
	Digital Inputs	Five (5) - 24VDC NPN or PNP, includes 1 configurable 32kHz frequency input	
	Digital Outputs	Two (2) - (1)-26VDC,100mA, configurable as 32kHz Pulse Output ; (1) Relay-250VAC/30VDC, 1A	
	Analog Inputs	Two (2) - (1) voltage or potentiometer, (1) selectable Voltage or Current	
	Analog Outputs	One (1) - selectable voltage (0-10 V) or current (0-20 mA)	
	Safe Torque Off	SA and SB inputs- 24VDC	
Function Characteristics	*Trip*	External signal trip ARM short circuit current trip Overheat trip Input imaging trip Ground trip Motor overheat trip I/O board link trip No motor trip Parameter writing trip Emergency stop trip Command loss trip External memory error CPU watchdog trip Motor normal load trip	Temperature sensor trip Inverter overheat Option trip Output imaging trip Inverter overload trip Fan trip Pre-PID operation failure External break trip Low voltage trip during operation Low voltage trip Safety A (B) trip Analog input error Motor overload trip
	Alarm	Command loss trip alarm, overload alarm, normal load alarm, drive overload alarm, fan operation alarm, resistance braking rate alarm, number of corrections on rotor tuning error	
	PCB Conformal Coating	IEC 60721-3-3(3C2), IEC 60068-2-43, IEC 60068-2-60	
Accessory	*Communication Card*	EtherNet/IP and Modbus TCP (ACN-ETH)	
	IO Extension	3 DI, 2 DO, 2 AI, 1 AO (ACN-EIO)	
Agency Approvals		UL, cUL, CE, TÜV NORD (SIL 2)	

IronHorse ACN Series General Specifications

ACN Environmental Specifications

Environmental Conditions for IronHorse ACN Series AC Drives	
Installation Location	IEC60529 standard IP66; NEMA standard 4X for indoor use. Not suitable for use in direct sunlight.
Cooling	Forced fan cooling structure Forced cooling type: 0.4-15 kW 230V/0.4-22 kW 460V (excluding some models)
Ambient Temperature	-10 to 40°C (14 to 104°F); No ice or frost should be present.
Storage Temperature*	-20° to 65°C (-4 to 149°F)
Relative Humidity	Max 90% (to avoid condensation)
Air Pressure	70 to 106 kPa
Pollution Level	Pollution level 3 environment: Prevent contact with corrosive gases, inflammable gases, oil stains, dust, and other pollutants.
Altitude	No higher than 3280ft (1000m). From 1000 to 4000m, the rated input voltage and rated output current of the drive must be derated by 1% for every 100m.
Vibration	Less than 9.8 m/sec^2 (1G)
Installation Orientation	Max allowed offset angle = 0 degrees. (Vertical orientation only). Do not install the drive on the floor or mount it sideways against a wall. The drive MUST be installed vertically, on a wall or inside a panel, with its rear flat on the mounting surface.

*** The ambient temperature is the temperature measured at a point 2" (5 cm) from the surface of the drive.**

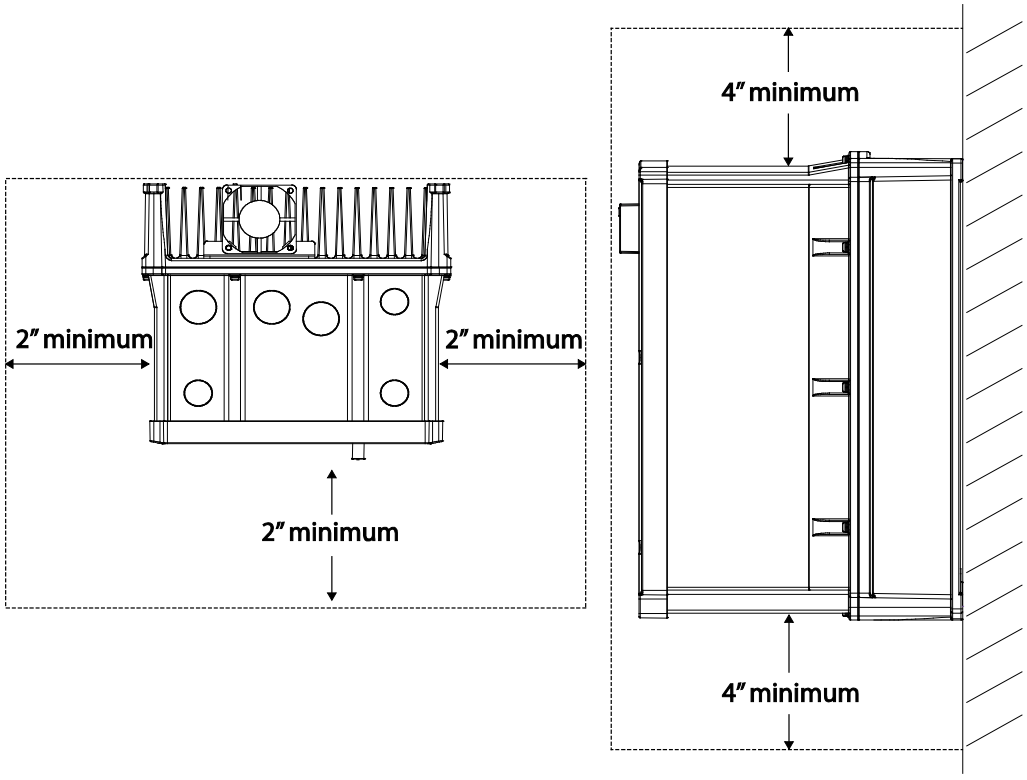
ACN Watt Loss and Efficiency

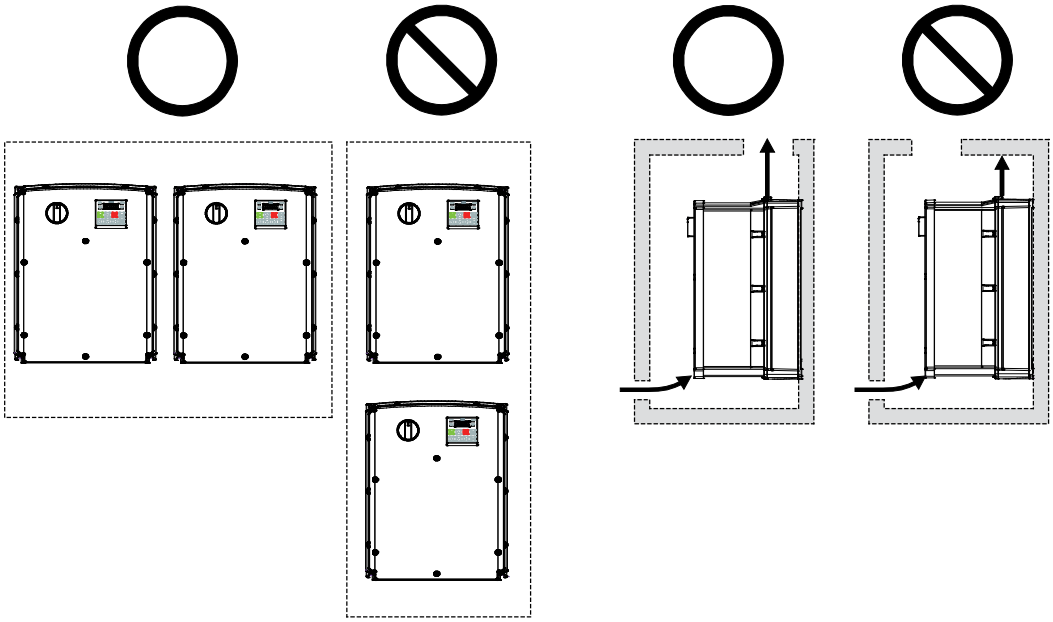
IronHorse ACN Watt Loss and Efficiency							
Model Number ACN(ND)-xxxx	***Voltage***	***Rated Power (kW)***	***Efficiency (%)***	***Total Losses (W)***	***Internal Losses (W)***	***External (Heat) Losses (W)***	***Heat Losses (Kcal)***
20P5	230	0.4	96.6	21.6	12.6	9	7.7
21P0	230	0.8	96.7	42.4	12.6	29.8	25.6
22P0	230	1.5	96.9	76.5	16.8	59.7	51.3
23P0	230	2.2	97	110	16.8	93.2	80.2
25P0	230	4	97.3	188	18.9	169.1	145.4
27P5	230	5.5	97.5	247.5	38.7	208.8	179.6
2010	230	7.5	97.5	337.5	38.7	298.8	257
2015	230	11	97.8	462	38.7	423.3	364
2020	230	15	98	600	38.7	561.3	482.7
40P5	460	0.4	96.7	21.2	12.6	8.6	7.4
41P0	460	0.8	96.7	42.4	12.6	29.8	25.6
42P0	460	1.5	96.9	76.5	16.8	59.7	51.3
43P0	460	2.2	97	110	16.8	93.2	80.2
45P0	460	4	97.3	188	21	167	143.6
47P5	460	5.5	97.4	253	43	210	180.6
4010	460	7.5	97.5	337.5	43	294.5	253.3
4015	460	11	97.5	495	43	452	388.7
4020	460	15	97.5	675	43	632	543.5
4025	460	18.5	97.6	814	43	771	663.1
4030	460	22	97.7	946	43	903	776.6

This watt loss and efficiency data were measured under the following test conditions:

- **Operation at 60Hz and room temperature**
- **100% load**
- **Carrier Frequency (Default value)**

IronHorse ACN Series Mounting Clearances





IronHorse ACN Series Input Terminals

Input Terminal Labels and Descriptions			
Function	***Label***	***Name***	***Description***
Multi-function digital input terminal configuration	P1–P5	Multi-function Input 1-5	Configurable for multi-function input terminals. Factory default terminals and setup are as follows: P1: Fx P2: Rx P3: BX P4: RST P5: Speed-L Use NPN/PNP dip switch to set terminal Sink/Source configuration NPN (Sink) : Px-CM, internal 24V (22~27V) On = 0V (CM) Off = 22V~27V (Internal 24V) PNP (Source) : Px-24V-CM, using external source On : ≥ 9V Off : ≤ 1.5 V
	CM	Common Sequence	Common terminal for analog and digital terminal inputs and outputs.
Analog input configuration	VR	Potentiometer frequency reference input	Used to setup or modify a frequency reference via analog voltage or current input. Maximum Voltage Output: 12V Maximum Current Output: 100mA Potentiometer: 1–5 kΩ
	V1	Voltage input for frequency reference input	Used to setup or modify a frequency reference via analog voltage input terminal. Unipolar: 0–10V (12V Max.) Bipolar: -10–10V (±12V Max.)
	I2	Voltage/current input for frequency reference input	Used to setup or modify a frequency reference via analog voltage or current input terminals. Switch between voltage (V2) and current (I2) modes using a control board switch (SW2). V2 Mode: Unipolar: 0–10V (12V Max.) I2 Mode Input current: 4–20mA Maximum Input current: 24mA Input resistance: 249Ω
	P5 (TI)	Pulse input for frequency reference input (pulse train)	Setup or modify frequency references using pulse inputs from 0 to 32kHz. Low Level: 0–2.5 V High Level: 3.5–12 V (Pulse input TI and Multi-function terminal P5 share the same terminal. Sel the In.69 P5 Define to 54(TI).)
Safety functionality configuration	SA	Safety input A	Used to block the drive output in an emergency. Conditions: Normal Operation: Both the SA and SB terminals are connected to the SC terminal. Output Block: One or both of the SA and SB terminals open connection with the SC terminal.
	SB	Safety input B	
	SC	Safety input power source	DC 24V, < 25mA

IronHorse ACN Series Output/ Communication Terminals

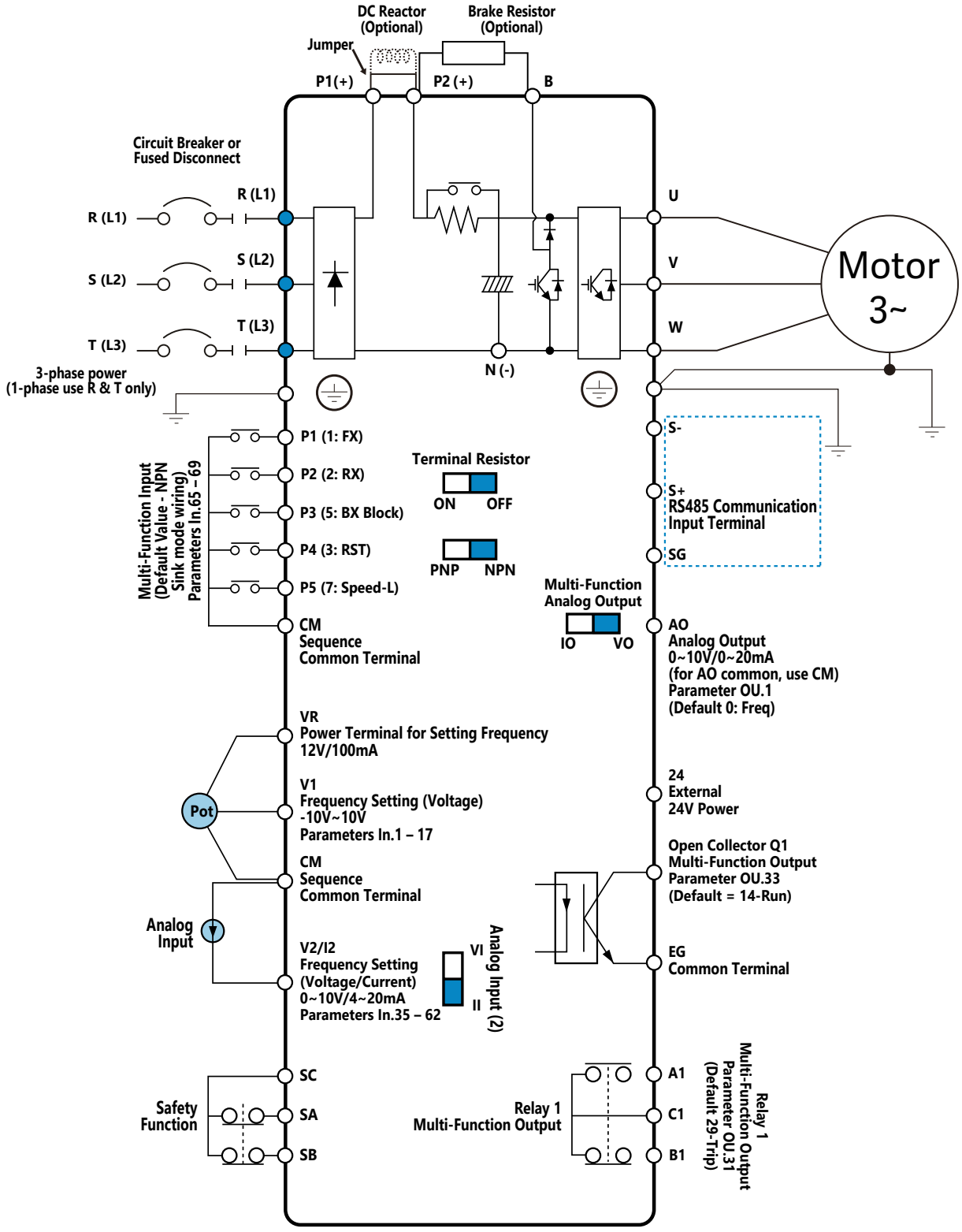
Output/Communication Terminal Labels and Descriptions

<table>
<tr><th>Function</th><th>Label</th><th>Name</th><th>Description</th></tr>
<tr><td rowspan="2">Analog output</td><td>AO</td><td>Voltage/Current Output</td><td>Configurable Analog Output to send drive output information to external devices: output frequency, output current, output voltage, or a DC voltage.
Operate switch (SW3) to select the signal output type (voltage or current) at the AO terminal. Use terminal CM for common connection.
Output Signal Specifications:
Output voltage: 0–10V
Maximum output voltage/current: 12V/10mA
Output current: 0–20mA
Maximum output current: 24mA
Factory default output: Frequency</td></tr>
<tr><td>Q1 (TO)</td><td>Pulse Output</td><td>Configurable pulse signals to external devices to provide a single output value from the drive: output frequency, output current, output voltage, or DC voltage.
Output Signal Specifications:
Output frequency: 0–32kHz
Output voltage: 0–12V
Factory default output: Frequency
(Pulse output TO and Multi-function output Q1 share the same terminal. Sel the OU.33-Q1 Define to 38(TO).)
Duty cycle 50% (0.01Hz) ~ 55% (60Hz)

Connect a pulse between ACN drives as follows:
<table><tr><th>ACN Drive #1</th><th></th><th>ACN Drive #2</th></tr><tr><th>Output Terminal</th><th></th><th>Input Terminal</th></tr><tr><td>Q1</td><td>→</td><td>P5</td></tr><tr><td>EG</td><td>→</td><td>CM</td></tr></table></td></tr>
<tr><td rowspan="4">Digital output</td><td>Q1</td><td>Multi-function Output (open collector)</td><td>DC 26V, 100mA or less
Factory default output: Run</td></tr>
<tr><td>EG</td><td>Common</td><td>Common ground contact for an open collector (with external power source)</td></tr>
<tr><td>24</td><td>External 24V power source</td><td>Maximum output current: 150mA</td></tr>
<tr><td>A1/C1/B1</td><td>Multi Function Output (Relay)</td><td>Configurable Relay output signal via Parameter OU.31.
Contact Rating: AC 250V <1A, DC 30V < 1A
Signal ON operation: A1-C1 contact closed, B1-C1 contact open
Signal OFF operation: B1-C1 contact closed, A1-C1 contact open</td></tr>
<tr><td rowspan="2">Communication</td><td>S+/S-/SG</td><td>RS-485 signal line</td><td>Used to send or receive RS-485 signals. Use the Terminating Resistor dip switch to set the end of line resistor in a communicaton network.</td></tr>
<tr><td>N/A</td><td>RJ45 Connector</td><td>Serial Connection to LCD keypad or PC software</td></tr>
</table>

IronHorse ACN Series Basic Wiring

Main Circuit Wiring Diagram: All Models

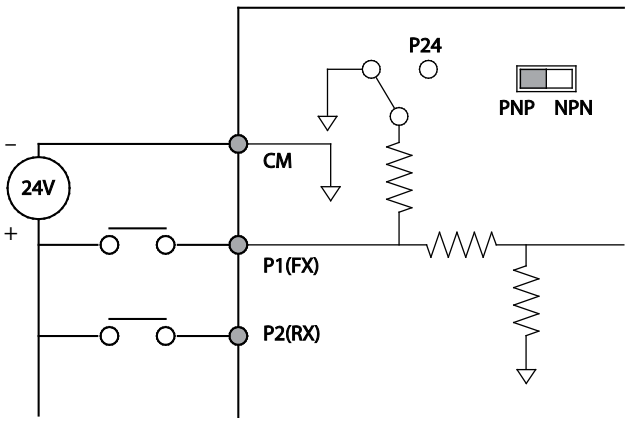


NOTE: Default is marked in blue.

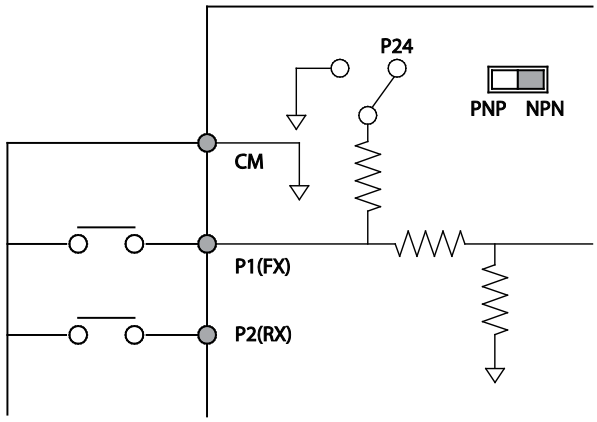
IronHorse ACN Series Basic Wiring

Control Circuit Wiring Diagram: Digital Inputs

Select PNP using the PNP/NPN selection switch (SW1). Note that the factory default setting is NPN mode. CM is the common ground terminal for all analog inputs at the terminal, and P24 is 24V internal source. If you are using an external 24V source, build a circuit that connects the external source (-) and the CM terminal.



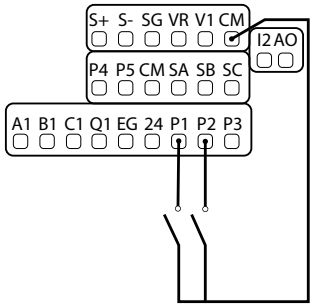
PNP Mode (Source)



NPN Mode (Sink)

2 and 3 Wire Control

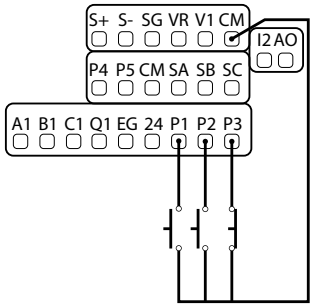
2-Wire Control



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.

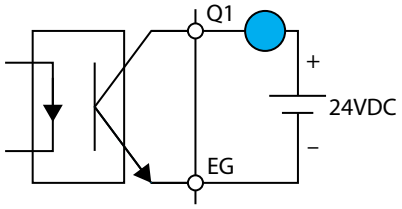
P1 = Forward Run (Fx)
P2 = Reverse Run (Rx)
P3 = Stop (3-Wire)
CM = CommonFrequency Reference Wiring

IronHorse ACN Series Basic Wiring

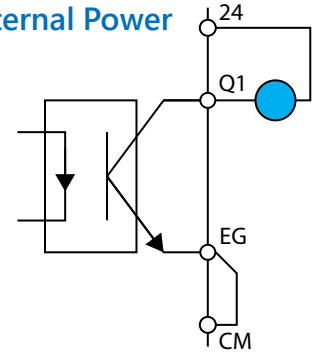
Digital Output Wiring

NOTE: Ensure device current does not exceed 100mA.

External Power

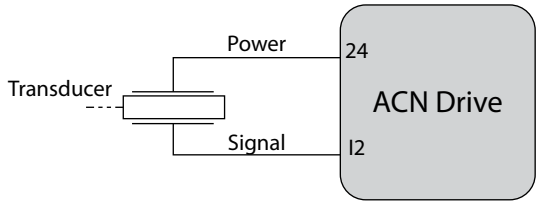


Internal Power



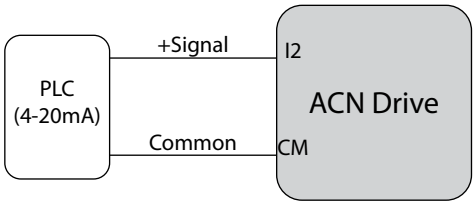
4-20mA Analog Input Wiring

Transducer (4-20mA): Transducers are typically 4-20mA devices which require a 24VDC power source. For 2-wire transducers connect to the 24VDC and 4-20mA input terminals listed below. Connect the positive lead of the device to the 24V terminal and the signal lead to the analog input terminal (I2).



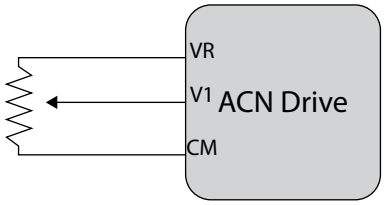
NOTE: Verify that SW2 dip switch on the terminal board to 'II' (down) for 4–20mA signal.

PLC (4-20mA): The wiring for connecting a PLC's 4-20mA output to the analog input of a VFD differs slightly from the transducer wiring discussed above. The positive (signal) lead is wired to the corresponding analog input while the negative (common) lead is wired to the drives common. Reference the figure below.

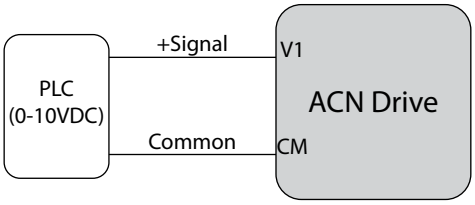


0-10VDC Analog Input Wiring

Speed POT/Rheostat (0-10VDC): Speed potentiometers have three wires which must be connected to properly vary a 0-10VDC signal. The required terminal connections will vary slightly depending on the drive series. Reference the figure below. The wiper of the speed POT should always be connected to the analog input.

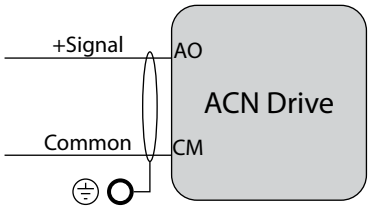


PLC (0-10VDC): The wiring for connecting a PLC's 0-10VDC output to the analog input of a VFD differs slightly from the speed POT wiring discussed above. The positive (signal) lead is wired to the corresponding analog input while the negative (common) lead is wired to the drives common. Reference the figure below.



AO Wiring

Wire the drive analog out as follows:



IronHorse ACN Series Accessories

Accessories Available for ACN Drives

ACN Drives Available Software and Accessories	
Accessory	***Reference***
Ethernet Module: ACN-ETH	ACN Extension I/O and Ethernet Module on page tIHA-16
Extension I/O: ACN-EIO	
Remote Keypad: ACN-LCD	Remote Keypad on page tIHA-18
Remote Keypad Mount Kit w/Cable: ACN-3MRC	
Remote Keypad NEMA4X Mount Kit w/Cable: ACN-LCDKM	
Replacement Fans: ACN-FAN-FR3, ACN-FAN-FR45	ACN Replacement Fans on page tIHA-41
Fuses/Circuit Breakers	Fuses/Circuit Breakers on page tIHA-20
EMI Filters	High Performance EMI Input Filters on page tIHA-21
Braking Resistors	Braking Resistors on page tIHA-23
Line Reactors/Voltage Time Filters	Line Reactors/Voltage Time Filters on page tIHA-22
VFD Suite	VFD Suite on page tIHA-47
USB to RJ45 Port Cable: ACN-232C	Communication Cable on page tIHA-47

ACN Extension I/O and Ethernet Module

The ACN-EIO Extension IO option card provides additional discrete and analog IO points for any ACN(ND) series drives. The ACN-ETH is an option module for connecting any ACN series drive to an ethernet network. The module supports both the EtherNet/IP and Modbus TCP protocols.

ACN Extension I/O and Ethernet Module		
Part Number	***Price***	***Description***
ACN-EIO	$205.00	IronHorse ACN series relay/analog combo module, Analog Input: 2-channel, current/voltage, Analog Output: 1-channel, current/voltage, Discrete Input: 3-point, sinking/sourcing, Discrete Output: 2-point, relay, (2) Form C (SPDT) relays.
ACN-ETH	$113.00	IronHorse ACN series communication module, EtherNet/IP and Modbus TCP, 1 port, (1) Ethernet (RJ45) and (1) RS-232 (RJ45) port(s). For use with IronHorse ACN series drives. Mounting hardware included.

ACN-EIO

ACN-ETH

IronHorse ACN Series Accessories

Remote Keypad

The Remote LCD keypad provides advanced functionality for use with the ACN series drives. The unit provides enhanced text descriptions of each parameter and enhanced failure status monitoring. The unit allows backup and download of drive parameters.

ACN Remote Keypad			
Part Number	***Price***	***Description***	***Drawing Links***
ACN-LCD	$65.00	IronHorse ACN series remote keypad, for use with IronHorse ACN series drives.	PDF
ACN-3MRC	$23.50	IronHorse ACN series keypad mount, for use with ACN-LCD remote keypad. (1) 9.8ft/3m Ethernet patch cable included.	PDF
ACN-LCDKM	$109.00	IronHorse ACN series keypad mount, NEMA 4X. For use with ACN-LCD remote keypad. (1) 9.8ft/3m Ethernet patch cable included.	PDF

ACN-3MRC

ACN-LCD

ACN-LCDKM

ACN Replacement Fans

The ACN-FAN-xxxx fans are replacement kits for the ACN drive fan(s) that comes installed with the drive.

ACN Replacement Fans			
Part Number	***Price***	***Description***	***Drawing Links***
ACN-FAN-FR3	$44.00	IronHorse ACN series main cooling fan, replacement, 60 x 60 x 25mm, 24 VDC. For use with ACN series 7-1/2hp - 10hp AC drives.	PDF
ACN-FAN-FR45	$66.00	IronHorse ACN series main cooling fan, replacement, 80 x 80 x 25mm, 24 VDC. For use with ACN series 15hp - 30hp AC drives.	PDF

ACN-FAN-FR3

ACN-FAN-FR45

IronHorse ACN Series Accessories

Fuses/Circuit Breakers

Protection devices are essential to prevent damage to your ACN drive and application equipment. Please use the fuse specification chart below to select fuses that are applicable to your ACN drive. Only use UL-certified 600V fuses which comply with your local regulations.

Drive	Drive Voltage	HP (CT)	Fuse Amps (Class H or RK5)	Suggested ADC Class RK5 Fuses	Circuit Breaker	
					Size	Model*
ACN(ND)-20P5	200-240	0.5	10	ECSR10	5	UTE10033C
ACN(ND)-21P0	200-240	1	10	ECSR10	10	
ACN(ND)-22P0	200-240	2	15	ECSR15	15	
ACN(ND)-23P0	200-240	3	20	ECSR20	20	
ACN(ND)-25P0	200-240	5	50	ECSR50	30	
ACN(ND)-27P5	200-240	7.5	50	ECSR50	50	UTE10053C
ACN(ND)-2010	200-240	10	63	ECSR60	60	UTE10063C
ACN(ND)-2015	200-240	15	80	ECSR80	100	UTE100103C
ACN(ND)-2020	200-240	20	100	ECSR100	125	
ACN(ND)-40P5	380-480	0.5	10	ECSR10	3	UTE10033C
ACN(ND)-41P0	380-480	1	10	ECSR10	5	
ACN(ND)-42P0	380-480	2	10	ECSR10	10	
ACN(ND)-43P0	380-480	3	15	ECSR15	10	
ACN(ND)-45P0	380-480	5	32	ECSR30	20	
ACN(ND)-47P5	380-480	7.5	32	ECSR30	30	
ACN(ND)-4010	380-480	10	35	ECSR35	30	
ACN(ND)-4015	380-480	15	50	ECSR50	50	UTE10053C
ACN(ND)-4020	380-480	20	63	ECSR60	60	UTE10063C
ACN(ND)-4025	380-480	25	70	ECSR70	75	UTE100103C
ACN(ND)-4030	380-480	30	100	ECSR100	100	

*** Manufactured by LS Electric. Not available at AutomationDirect.com**

CAUTION: ONLY USE 600V CLASS H OR RK5, UL LISTED INPUT FUSES AND UL LISTED CIRCUIT BREAKERS. SEE THE TABLE ABOVE FOR THE CURRENT RATINGS FOR FUSES AND CIRCUIT BREAKERS.
MAXIMUM ALLOWED PROSPECTIVE SHORT-CIRCUIT CURRENT AT THE INPUT POWER CONNECTION IS DEFINED IN IEC 60439-1 AS 100 KA. DEPENDING ON THE SELECTED MCCB, THE ACN SERIES IS SUITABLE FOR USE IN CIRCUITS CAPABLE OF DELIVERING A MAXIMUM OF 100 KA RMS SYMMETRICAL AMPERES AT THE DRIVE'S MAXIMUM RATED VOLTAGE. THE FOLLOWING TABLE SHOWS THE RECOMMENDED MCCB FOR RMS SYMMETRICAL AMPERES.

IronHorse ACN Series Accessories

High Performance EMI Input Filters

The optional accessories below are available for use with the ACN drive. Selection of these accessories is application specific and may improve drive performance. Additional information regarding filter installation and operation is available in the AutomationDirect white paper, "Applied EMI/RFI Techniques."

Drive	Drive Voltage	HP (CT)	Roxburgh Filters Chassis Type 1ph *1	Roxburgh High Performance Filters *2	Roxburgh Max Performance Filters *3
ACN(ND)-20P5	200-240	0.5	RES90F03	KMF306A	MIF310
ACN(ND)-21P0	200-240	1	RES90F10	KMF310A	MIF310
ACN(ND)-22P0	200-240	2	RES90F16	KMF318A	MIF316
ACN(ND)-23P0	200-240	3	RES90F16	KMF318A	MIF316
ACN(ND)-25P0	200-240	5	RES90S20	KMF325A	MIF323
ACN(ND)-27P5	200-240	7.5	–	KMF336A	MIF350
ACN(ND)-2010	200-240	10	–	KMF350A	MIF350
ACN(ND)-2015	200-240	15	–	KMF370A	MIF375
ACN(ND)-2020	200-240	20	–	KMF3100A	MIF3100
ACN(ND)-40P5	380-480	0.5	–	KMF306A	MIF310
ACN(ND)-41P0	380-480	1	–	KMF306A	MIF310
ACN(ND)-42P0	380-480	2	–	KMF306A	MIF310
ACN(ND)-43P0	380-480	3	–	KMF310A	MIF310
ACN(ND)-45P0	380-480	5	–	KMF318A	MIF316
ACN(ND)-47P5	380-480	7.5	–	KMF318A	MIF323
ACN(ND)-4010	380-480	10	–	KMF336A	MIF330B
ACN(ND)-4015	380-480	15	–	KMF336A	MIF350
ACN(ND)-4020	380-480	20	–	KMF350A	MIF350
ACN(ND)-4025	380-480	25	–	KMF350A	MIF350
ACN(ND)-4030	380-480	30	–	KMF370A	MIF375

***1 -EMI rating for motor cable length: C2 to 75Ft, C1 to 30ft**
***2 -EMI rating for motor cable length: C2 to 150Ft, C1 to 75ft**
***3 -EMI rating for motor cable length: C2 to 300Ft, C1 to 150ft**

IronHorse ACN Series Accessories

Line Reactors/Voltage Time Filters

Installing an AC Line Reactor on the input side of an AC motor drive can increase line impedance, improve the power factor, reduce input current, increase system capacity, and reduce interference generated from the motor drive.

Installing a load reactor or voltage time filter on the drive's output side can increase the high-frequency impedance to reduce the dV/dT and terminal voltage to protect the motor. Use output filters if the motor cable length exceeds 100ft

Line/Load Reactors & AC Output Filters											
Drive	Voltage	HP	Input (Amps)	Output FLA 3ph (Amps)	AC Input Line Reactor		AC Output Load Reactor		AC dVdT Output Filter		DC reactor values Induct./ Current
					3ph	1ph	3ph	1ph	3ph	1ph	
ACN(ND)-20P5	200-240	0.5	2.2	5	LR2-20P5	LR2-20P2	LR2-20P5	LR2-20P2	VTF-246-CFG	VTF-46-DE	4/8.67
ACN(ND)-21P0		1	4.9	8	LR2-21P0	LR2-21P0	LR2-21P0	LR2-20P5	VTF-24-FH	VTF-246-CFG	
ACN(ND)-22P0		2	8.4	11	LR-23P0	LR-25P0	LR2-22P0	LR2-22P0	VTF-246-GJJ	VTF-24-FH	3/13.05
ACN(ND)-23P0		3	11.8	17	LR-23P0	LR-23P0	LR2-22P0	LR2-22P0	VTF-4-M	VTF-246-GJJ	1.33/18.45
ACN(ND)-25P0		5	18.5	24	LR-25P0	LR-2010	LR-25P0	LR2-22P0	VTF-46-LM	VTF-246-HKL	1.33/26.35
ACN(ND)-27P5		7.5	25.8	32	LR-2010	LR-2015	LR-27P5	LR-25P0	VTF-246-KMN	VTF-24-JL	1.60/32
ACN(ND)-2010		10	34.9	46	LR-2015	LR-2020	LR-2010	LR-25P0	VTF-246-LPQ	VTF-46-LM	1.25/43
ACN(ND)-2015		15	50.8	60	LR-2020	LR-2030	LR-2015	LR-2010	VTF-246-NRS	VTF-46-NP	0.95/61
ACN(ND)-2020		20	66.7	1.3	LR-2025	LR-2040	LR-2020	LR-2010	VTF-246-PSU	VTF-246-LPQ	0.70/75
ACN(ND)-40P5	380-480	0.5	1.1	2.5	LR2-40P5				VTF-46-DE		16/4.27
ACN(ND)-41P0		1	2.4	4	LR2-41P0				VTF-246-CFG		
ACN(ND)-42P0		2	4.2	5.5	LR2-42P0				VTF-246-DGH		12/6.41
ACN(ND)-43P0		3	5.9	9	LR2-43P0				VTF-24-FH		8/8.9
ACN(ND)-45P0		5	9.8	12	LR2-45P0				VTF-46-DE		5.4/13.2
ACN(ND)-47P5		7.5	12.9	16	LR2-47P5				VTF-46-DE		3.20/17
ACN(ND)-4010		10	17.5	24	LR-4010				VTF-24-JL		2.50/25
ACN(ND)-4015		15	26.5	30	LR-4015				VTF-246-KMN		1.90/32
ACN(ND)-4020		20	33.4	39	LR-4020				VTF-246-LPQ		1.40/41
ACN(ND)-4025		25	43.6	45	LR-4025				VTF-246-MQR		1.00/49
ACN(ND)-4030		30	50.7	27	LR-4030				VTF-246-MQR		0.70/64

IronHorse ACN Series Accessories

Braking Resistors

Dynamic braking absorbs the motor regeneration energy when the motor is decelerated faster than it would if it was allowed to coast to a stop. The regeneration energy is dissipated by braking resistors. All drives have the braking function built-in and do not require a separate dynamic braking unit. The recommended open type or NEMA 1 type brake resistors available at AutomationDirect for each drive model are listed in the table below.

Brake Resistors

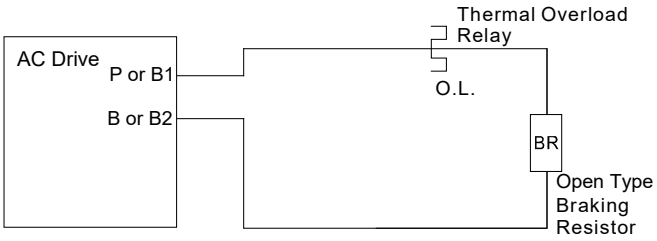
Voltage	Drive	Drive Power (HP)	Drive Braking Capacity-Max Torque			150% Braking Torque @ 5% Duty Cycle					
						Open Type Resistors			NEMA1 Resistors with Thermal Switch		
			Minimum Resistor	Max Total Brake Current (A)	Peak Power (kW)	ADC Part Number	Qty	Total Brake Current (A)	ADC Part Number	Qty	Total Brake Current (A)
230	ACN(ND)-20P5	0.5	250.0	1.6	0.6	GS-BR-300W250	1	1.6	BR-N1-240W250	1	1.6
	ACN(ND)-21P0	1	150.0	2.6	1.0	GS-BR-400W150	1	2.6	BR-N1-240W150	1	2.6
	ACN(ND)-22P0	2	50.0	7.8	3.0	GS-BR-300W070	1	5.6	BR-N1-280W50	1	7.8
	ACN(ND)-23P0	3	43.0	9.1	3.5	GS-BR-1K5W043	1	9.1	BR-N1-720W50	1	7.8
	ACN(ND)-25P0	5	25.0	15.6	6.1	GS-BR-1K2W015	2S	13.0	BR-N1-800W25	1	15.6
	ACN(ND)-27P5	7.5	18.0	21.7	8.5	GS-BR-1K0W020	1	19.5	BR-N1-800W18P0	1	21.7
	ACN(ND)-2010	10	14.0	27.9	10.9	GS-BR-1K2W015	1	26.0	BR-N1-1K5W14P0	1	27.9
	ACN(ND)-2015	15	8.6	45.3	17.7	GS-BR-1K5W012	1	32.5	BR-N1-2K2W08P6	1	45.3
	ACN(ND)-2020	20	8.0	48.8	19.0	GS-BR-1K2W015	2P	52.0	BR-N1-2K2W08P6	1	45.3
460	ACN(ND)-40P5	0.5	400.0	2.0	1.5	GS-BR-300W400	1	2.0	BR-N1-250W400	1	2.0
	ACN(ND)-41P0	1	400.0	2.0	1.5		1			1	
	ACN(ND)-42P0	2	250.0	3.1	2.4		1		BR-N1-240W250	1	3.1
	ACN(ND)-43P0	3	180.0	4.3	3.4	GS-BR-200W360	2P	4.3	BR-N1-500W200	1	3.9
	ACN(ND)-45P0	5	85.0	9.2	7.2	GS-BR-300W250	2P	6.2	BR-N1-720W85	1	9.2
	ACN(ND)-47P5	7.5	75.0	10.4	8.1	GS-BR-1K0W075	1	10.4	BR-N1-1K2W75	1	10.4
	ACN(ND)-4010	10	49.0	15.9	12.4	GS-BR-1K5W043	1	18.1	BR-N1-1K2W50	1	15.6
	ACN(ND)-4015	15	40.0	19.5	15.2	GS-BR-1K5W043	1	18.1	BR-N1-1K5W40	1	19.5
	ACN(ND)-4020	20	22.0	35.5	27.7		2P	36.3	BR-N1-2K3W26	1	30.0
	ACN(ND)-4025	25	20.0	39.0	30.4		2P		BR-N1-2K8W25	1	31.2
	ACN(ND)-4030	30	20.0	39.0	30.4		2P		BR-N1-3K6W20	1	39.0

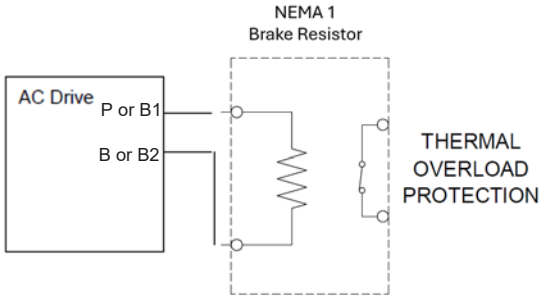
Note: Where noted in resistor quantity, S = series, P = parallel

Brake Wiring

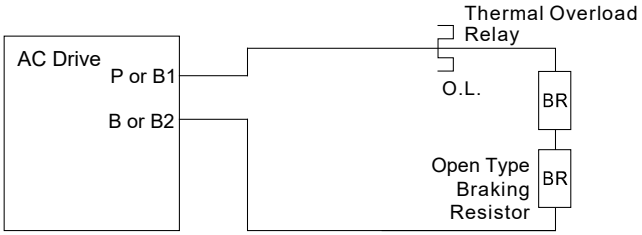
Use your drive's braking component selection table to determine the appropriate brake resistor model and configuration for your drive. Refer to the diagrams below for examples on how to wire each possible configuration.

Drive + 1 Resistor or NEMA1 Resistor:

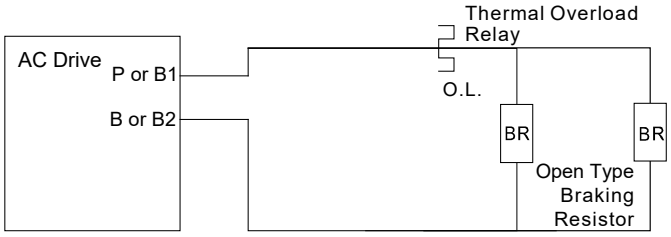




Drive + 2 Series Resistors



Drive + 2 Parallel Resistors



IronHorse AC Series Accessories

VFD Suite

VFD Suite is the configuration software for the Automation Direct Ironhorse AC family of variable frequency drives, featuring the ACG IP20 series and the ACN Nema4X series. It is designed to allow connection of a personal computer to the drives and perform a variety of functions:

- Create new drive configurations
- Upload/Download drive configurations
- Edit/Compare drive configurations
- Utilize Parameter Wizard for easy configuration
- Archive/Store multiple drive configurations on your PC
- Trend drive operation parameters
- Tune the drive PID loop
- View real time key operating parameters
- Start/Stop drive and switch directions, provided drive is set up for remote operation
- View drive faults
- Program Function blocks for simple control applications (ACN series only, 18 steps maximum)

VFD Suite includes a PDF help file for explanation of the software and features. VFD Suite can be downloaded for free from Automationdirect.com.

System Requirements

Category	Requirement
Windows	Windows 8/10/11
Processor	1 GHz or higher
RAM	1 GB (32-bit) or 2 GB (64-bit)
HDD	16 GB (32-bit) or 20 GB (64-bit)
Graphics	Graphic card supporting MS DirectX 9

Communication Cable

(For ACN series drives only)

ACN-232C

Communication Cable			
Part Number	**Price**	**Description**	**Drive Compatibility**
ACN-232C	$110.00	IronHorse programming/communication cable, 3.2ft/1m cable length, RS-232 (RJ45 8P8C) to USB A. For use with IronHorse ACN series drives.	ACN series drives only