



IronHorse ACG Series Introduction



IronHorse ACG AC 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 1-Phase Input/ 230V 3-Phase Output	✓	✓	✓	✓	✓	✓	✓	✓				
230V 3-Phase Input/ 230V 3-Phase Output	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
460V 1-Phase Input/ 460V 3-Phase Output	✓	✓	✓	✓	✓	✓	✓	✓	✓			
460V 3-Phase Input/ 460V 3-Phase Output	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Overview

The Ironhorse ACG sensorless vector control AC drives provide all the features needed for a variety of applications in a compact and durable package. 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. Ironhorse ACG AC drives offer several different control modes: V/Hz, Slip compensation, and sensorless vector. It even provides Torque limit capability. Ironhorse ACG provides either voltage or current analog input for drive control, one analog output, five digital inputs, and two relay outputs. All of the analog and digital I/O can be configured for a wide variety of input or output functions. One option card port is available for an Ethernet/IP and Modbus TCP communication option card or remote mounted keypad. Durability is enhanced through UL 61800-5-3 conformance and robust military spec design.

Features

- Broad offering from 1/2 to 30 hp
- 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
- Heavy Load (Constant Torque), Normal Load (Variable Torque) ratings
- Flexible carrier frequency to 15khz
- Output frequency to 400Hz (120Hz sensorless vector)
- Built-in RJ45 port for fast & easy programming.
- Free downloadable software for drive configuration
- Local/Remote control mode selection or digital/comm input with Hand/Off/Auto control
- PCB Conformal Coating
- Meets UL 61800-5-1 standards
- 100kA Short Circuit Current Rating
- Durable MIL217Plus based design
- DC Bus Connection for 15-30 hp drives
- Analog I/O – configurable current/voltage input and 1 output
- 2-Motor Control
- Built-in Dynamic Braking – optional resistors
- KEB Operation (Kinetic Energy Buffering) - for ride through of power loss
- PID Controller – including sleep and wake
- Built-in Potentiometer
- Password protection
- High speed communication interfaces with MODBUS RTU built in, with optional EtherNet/IP and ModbusTCP Communication Card
- DIN rail mounting built in on 5hp and lower for zero stack installation.
- Able to operate at 50°C ambient temperature
- 24 month warranty
- CE, UL, cUL

Accessories

- EtherNet/IP and ModbusTCP comm card
- AC line reactors
- dV/dT output filters
- EMI filters
- Braking resistors
- Fuses
- Remote Keypad Mount Kit
- VFD Suite drive configuration software

Typical Applications

Suitable for most applications, including:

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



IronHorse ACG Series Selection

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. <i>NOTE: FLA of motors that have been rewound may be higher than stated.</i>															
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. <i>NOTE: Applications that require replacement of existing motor starters with AC drives may require up to 600% overload.</i>															
Determine Application Type: Heavy Load (HD) or Normal Load (ND)															
This torque requirement has a direct effect on which drive to select. Normal load (or variable torque) applications are generally easier to start; typically fans and pumps. Most other applications outside fans and pumps fall into the heavy load (or constant torque) category (machine control, conveyors, etc.). If you are unsure of the application, assume heavy load.															
Installation Altitude															
AC drives rely on air flow for cooling. ACG 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. <i>NOTE: For use above 1000m, the AC drive must be derated as described below.</i>															
Derate Output Current Based on Altitude Above 1000 Meters															
<ul style="list-style-type: none"> • 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. 															
<p>Derating for Altitude</p> <table border="1" style="margin: 10px auto;"> <caption>Data for Derating for Altitude</caption> <thead> <tr> <th>Altitude (m)</th> <th>Current Rated Ratio (%)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>100</td> </tr> <tr> <td>1000</td> <td>100</td> </tr> <tr> <td>2000</td> <td>90</td> </tr> <tr> <td>3000</td> <td>80</td> </tr> <tr> <td>4000</td> <td>70</td> </tr> <tr> <td>5000</td> <td>0</td> </tr> </tbody> </table>		Altitude (m)	Current Rated Ratio (%)	0	100	1000	100	2000	90	3000	80	4000	70	5000	0
Altitude (m)	Current Rated Ratio (%)														
0	100														
1000	100														
2000	90														
3000	80														
4000	70														
5000	0														



IronHorse ACG Series Selection

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 ACG 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

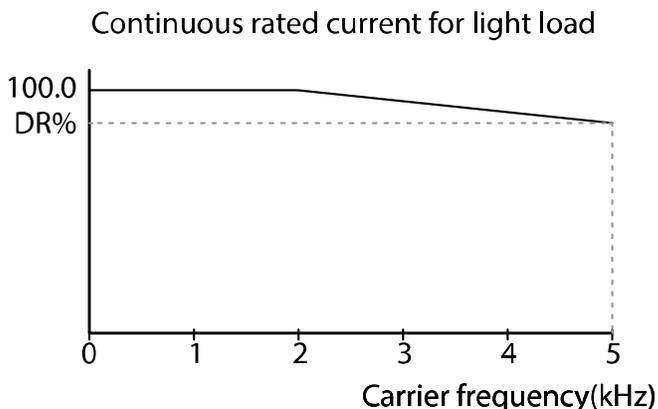
Benefits of Lower Carrier Frequencies:

- 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

Capacity (hp)	Drive Voltage	
	230V DR (%)	460V DR (%)
0.5	88	74
1	88	86
2	88	84
3	94	85
5	96	93
7.5	85	81
10	85	77
15-30	80	80





IronHorse ACG Series Selection Specifications

ACG 230V Class Specifications; Frame Sizes A-F												
Part Number			ACG-20P5	ACG-21P0	ACG-22P0	ACG-23P0	ACG-25P0	ACG-27P5	ACG-2010	ACG-2015	ACG-2020	
Price			\$067eo:	\$067ep:	\$067eq:	\$067es:	\$067et:	\$-067ei:	\$-067ej:	\$067ek:	\$;-0067el:	
Frame Size			A		B		C	D		E	F	
Drawing Link			PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	PDF	
Applied Motor	Heavy Load (HD)	hp	0.5	1.0	2.0	3.0	5.0	7.5	10	15	20	
		kW	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	
	Normal Load (ND)	hp	1.0	2.0	3.0	5.0	7.5	10	15	20	25	
		kW	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	
Output Rating	Rated Capacity	HD kVA	1.0	1.9	3.0	4.2	6.5	9.1	12.2	17.9	22.9	
		ND kVA	1.2	2.3	3.8	4.6	6.9	11.4	15.2	21.3	26.7	
	Rated Current - 3ph input	HD A	2.5	5.0	8.0	11.0	17.0	24.0	32.0	47	60	
		ND A	3.1	6.0	9.6	12.0	18.0	30.0	40.0	56	70	
	Rated Current - 1ph input (60Hz)	HD A	1.5	2.8	4.6	6.1	9.3	12.8	17.4	26.8	34	
		ND A	2.0	3.6	5.9	6.7	9.8	16.3	22.0	31	38	
	Rated Current - 1ph input (50Hz)	HD A	1.5	2.7	4.5	5.9	9.1	12.4	16.9	26	33.1	
		ND A	1.9	3.5	5.7	6.5	9.5	15.8	21.3	30	36.9	
	Output Frequency	Hz	0-400 Hz (IM Sensorless: 0-120 Hz)									
	Output Voltage	V	3-phase 200-240 V									
	Input Voltage - 3ph input	V	3-phase 200-240 VAC (-15% to +10%)									
	Input Voltage - 1ph input	V	1-phase 240VAC (-5% to +10%)									
Input Frequency - 3ph input	Hz	50-60 Hz (±5%)										
Input Frequency - 1ph input	Hz	60Hz (±5%)										
Rated Current - 1 or 3ph input	HD A	2.2	4.9	8.4	11.8	18.5	25.8	34.9	53.2	68.4		
	ND A	3.0	6.3	10.3	13.1	19.4	32.7	44.2	63.8	79.8		
Weight (lb [kg])		2.29 [1.04]	2.34 [1.06]	3.0 [1.36]	3.09 [1.4]	4.17 [1.89]	6.79 [3.08]	7.08 [3.21]	10.7 [4.84]	16.8 [7.6]		
Cooling Method		Forced Fan										
<ul style="list-style-type: none"> The standard motor capacity is based on a standard 4-pole motor. The standard used for 230V drives is based on a 220V supply voltage. The rated output current is limited based on the carrier frequency set at Cn.4. 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). For Single Phase Power input, an Input Line Reactor is required. See accessories for the specific line reactor for each drive model. 												



ACG-20P5



ACG-2020



IronHorse ACG Series Selection Specifications

ACG 460V Class Specifications; Frame Sizes A-C									
Part Number			ACG-40P5	ACG-41P0	ACG-42P0	ACG-43P0	ACG-45P0		
Price			\$067en:	\$067eu:	\$067ev:	\$067ex:	\$067ey:		
Frame Size			A	A	B	B	C		
Drawing Link			PDF	PDF	PDF	PDF	PDF		
Applied Motor	Heavy Load (HD)		hp	0.5	1.0	2.0	3.0	5.0	
			kW	0.3	0.75	1.5	2.2	4.0	
	Normal Load (ND)		hp	1.0	2.0	3.0	5.0	7.5	
			kW	0.75	1.5	2.2	4.0	5.5	
Output Rating	Rated Capacity		HD	kVA	1.0	1.9	3.0	4.2	6.5
			ND	kVA	1.5	2.4	3.9	5.3	7.6
	Rated Current-3ph input		HD	A	1.3	2.5	4.0	5.5	9.0
			ND	A	2.0	3.1	5.1	6.9	10.0
	Rated Current-1ph input (60Hz)		HD	A	0.7	1.4	2.1	2.8	4.9
			ND	A	1.3	1.9	2.8	3.6	5.4
	Rated Current-1ph input (50Hz)		HD	A	0.7	1.4	2.0	2.7	4.8
			ND	A	1.3	1.8	2.7	3.5	5.2
	Output Frequency			Hz	0-400 Hz (IM Sensorless: 0-120 Hz)				
	Output Voltage			V	3-phase 380-480 V				
Input Voltage-3ph input			V	380-480 VAC (-15% to +10%)					
Input Voltage-1ph input			V	480VAC (-5% to +10%)					
Input Frequency-3ph input			Hz	50-60 Hz (±5%)					
Input Frequency-1ph input			Hz	60Hz (±5%)					
Rated Current-1 or 3ph input		HD	A	1.1	2.4	4.2	5.9	9.8	
		ND	A	2.0	3.3	5.5	7.5	10.8	
Weight (lb [kg])			2.25 [1.02]	2.34 [1.06]	3.09 [1.4]	3.13 [1.42]	4.23 [1.92]		
Cooling Method			Forced Fan						

- The standard motor capacity is based on a standard 4-pole motor.
- The standard used for 460V drives is based on a 440V supply voltage.
- The rated output current is limited based on the carrier frequency set at Cn.4.
- 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).
- For Single Phase Power input, an Input Line Reactor is required. See accessories for the specific line reactor for each drive model.



ACG-40P5



ACG-43P0



IronHorse ACG Series Selection Specifications

ACG 460V Class Specifications; Frame Sizes D-F									
Part Number			ACG-47P5	ACG-4010	ACG-4015	ACG-4020	ACG-4025	ACG-4030	
Price			\$067ez:	\$.067e]:	\$;.0067e[:	\$;.0067e_:	\$;.0067e#:	\$;.0067e!:	
Frame Size			D		E		F		
Drawing Link			PDF	PDF	PDF	PDF	PDF	PDF	
Applied Motor	Heavy Load (HD)	hp	7.5	10	15	20	25	30	
		kW	5.5	7.5	11	15	18.5	22	
	Normal Load (ND)	hp	10	15	20	25	30	40	
		kW	7.5	11	15	18.5	22	30	
Output Rating	Rated Capacity	HD	kVA	9.1	12.2	18.3	23.6	29.7	34.3
		ND	kVA	12.2	17.5	23.6	29.0	34.3	46.5
	Rated Current-3ph input	HD	A	12.0	16.0	24	31	39	45
		ND	A	16.0	23.0	31	38	45	61
	Rated Current-1ph input (60Hz)	HD	A	6.4	8.7	15	18	23	27
		ND	A	8.7	12.6	18	23	27	35
	Rated Current-1ph input (50Hz)	HD	A	6.2	8.5	14.6	17.4	22.3	26.2
		ND	A	8.4	12.2	17.4	22.2	26.1	33.8
	Output Frequency	Hz	0-400 Hz (IM Sensorless: 0-120 Hz)						
	Output Voltage	V	3-phase 380-480 V						
Input Rating	Input Voltage-3ph input		V	380-480 VAC (-15% to +10%)					
	Input Voltage-1ph input		V	480VAC (-5% to +10%)					
	Input Frequency-3ph input		Hz	50-60 Hz (±5%)					
	Input Frequency-1ph input		Hz	60Hz (±5%)					
	Rated Current-1 or 3ph input	HD	A	12.9	17.5	27.2	35.3	44.5	51.9
ND		A	17.5	25.4	35.3	43.3	51.9	70.8	
Weight (lb [kg])			6.79 [3.08]	6.88 [3.12]	10.8 [4.89]	10.8 [4.91]	16.8 [7.63]	16.9 [7.65]	
Cooling Method			Forced Fan						

- The standard motor capacity is based on a standard 4-pole motor.
- The standard used for 460V drives is based on a 440V supply voltage.
- The rated output current is limited based on the carrier frequency set at Cn.4.
- 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).
- For Single Phase Power input, an Input Line Reactor is required. See accessories for the specific line reactor for each drive model.



ACG-47P5



ACG-4030



IronHorse ACG Series General Specifications

ACG General Specifications

IronHorse ACG Series General Specifications (All Models)			
Control Characteristics	Control Method	V/F control, Slip Compensation, Sensorless Vector	
	Frequency Settings Power Resolution	Digital command: 0.01 Hz Analog command: 0.06 Hz (60Hz standard)	
	Frequency Accuracy	1% of maximum output frequency	
	V/F Pattern	Linear, square reduction, user V/F	
	Overload Capacity	Heavy load rated current: 150% for 1 minute Normal load rated current: 120% for 1 minute	
	Torque Boost	Manual torque boost, automatic torque boost	
Operation Characteristics	Operation Type	Select key pad, terminal strip, or communication operation	
	Frequency Setting Signal	Analog type: -10~10 V, 0~10 V, 4~20 mA, keypad built-in potentiometer dial Digital type: keypad	
	Main Functions	<ul style="list-style-type: none"> • PID control • 3-wire operation • Frequency limit • Second motor function • Anti-forward and reverse direction rotation • Commercial transition • Speed search • Power braking • Up-down operation <ul style="list-style-type: none"> • DC braking • Frequency jump • Slip compensation • Automatic restart • Automatic tuning • Energy buffering • Flux braking • Fire mode 	
	Input	Multi-function Terminal (5) P1-P5	Select PNP (Source) or NPN (Sink) mode. Functions can be set according to In.65–In.69 codes and parameter settings.
			<ul style="list-style-type: none"> • Forward direction operation • Reset • Emergency Stop • Multi-step speed frequency-high/med/low • DC braking during stop • Frequency increase • 3-wire • Select acc/dec/stop <ul style="list-style-type: none"> • Reverse run • External trip • Jog operation • Multi-step acc/dec-high/med/low • Second motor selection • Frequency reduction • Fix analog command frequency • Transition from PID to general operation
		Analog Input (2)	-10 to 10 V, 0~10 V, 4~20 mA, Speed or PID control
	Output	Multi-function relay terminal (2)	Fault output and drive operation status output
Analog Output (1)		0~12 VDC: Select frequency, output current, output voltage, DC terminal voltage and others	
Protection Function Characteristics	Trip	<ul style="list-style-type: none"> • Overcurrent trip • External signal trip • ARM short circuit current trip • Overheat trip • In phase open 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 light load trip <ul style="list-style-type: none"> • Overvoltage trip • Temperature sensor trip • Drive overheat • Option trip • Out phase open trip • Drive overload trip • Fan trip • Pre-PID operation failure • External break trip • Low voltage trip during operation • Low voltage trip • Analog input error • Motor overload trip • Over-torque trip • Under-torque trip 	
	Alarm	Command loss trip alarm, overload alarm, light load alarm, drive overload alarm, fan operation alarm, resistance braking rate alarm, number of corrections on rotor tuning error, drive pre-overheat alarm, over-torque alarm, under-torque alarm	
	Instantaneous Blackout	Heavy load less than 15ms (normal load less than 8ms): must be within the rated input voltage and rated output range Heavy load more than 15ms (normal load more than 8ms): auto-restart operation	
Communication Card Option		EtherNet/IP and Modbus TCP (ACG-ET2)	
Agency Approvals		UL, CE	



IronHorse ACG Series General Specifications

ACG Environmental Specifications

Environmental Conditions for IronHorse ACG Series AC Drives	
Installation Location	Mount the drive on a wall or inside a panel. Not suitable for use in direct sunlight.
Cooling	Forced fan cooling structure Forced cooling type: 1/2–15 hp 230V/1/2–30 hp 460V (excluding some models)
Operating Ambient Temperature	Heavy Load (HD): -10 to 50°C (14 to 122°F) Normal Load (ND): -10 to 40°C (14 to 104°F)
Storage Temperature*	-20° to 65°C (-4 to 149°F)
Relative Humidity	Less than 95% (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 back flat on the mounting surface.

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

ACG Watt Loss and Efficiency

IronHorse ACG Watt Loss and Efficiency							
Model Number	Voltage	Rated Power (hp) [kW]	Efficiency (%)	Total Losses (W)	Internal Losses (W)	External (Heat) Losses (W)	Heat Losses (Kcal)
ACG-20P5	230	1/2 [0.4]	96.40	18.4	16.8	1.6	1.4
ACG-21P0		1 [0.8]	96.40	36.8	16.8	20.0	17.2
ACG-22P0		2 [1.5]	96.70	64.5	17.4	47.1	40.5
ACG-23P0		3 [2.2]	96.70	94.6	17.4	77.2	66.4
ACG-25P0		5 [4]	96.80	168.0	17.7	150.3	129.2
ACG-27P5		7 [5.5]	96.90	225.5	18.7	206.8	177.8
ACG-2010		10 [7.5]	96.90	307.5	18.7	288.8	248.3
ACG-2015		15 [11]	97.71	362.5	23.8	338.7	291.2
ACG-2020		20 [15]	97.89	466.8	38.2	428.6	368.6
ACG-40P5		460	1/2 [0.4]	96.00	20.0	17.4	2.6
ACG-41P0	1 [0.8]		96.80	33.6	17.4	16.2	14.0
ACG-42P0	2 [1.5]		97.30	55.5	17.7	37.8	32.5
ACG-43P0	3 [2.2]		97.50	77.0	17.7	59.3	51.0
ACG-45P0	5 [4]		97.60	136.0	18.7	117.3	100.8
ACG-47P5	7 [5.5]		97.80	176.0	19.7	156.3	134.4
ACG-4010	10 [7.5]		97.80	240.0	19.7	220.3	189.4
ACG-4015	15 [11]		98.50	274.7	23.8	250.9	215.8
ACG-4020	20 [15]		98.35	397.4	23.8	373.6	321.3
ACG-4025	25 [18.5]		98.55	454.0	38.2	415.8	357.6
ACG-4030	30 [22]		98.65	517.0	38.2	478.8	411.8

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

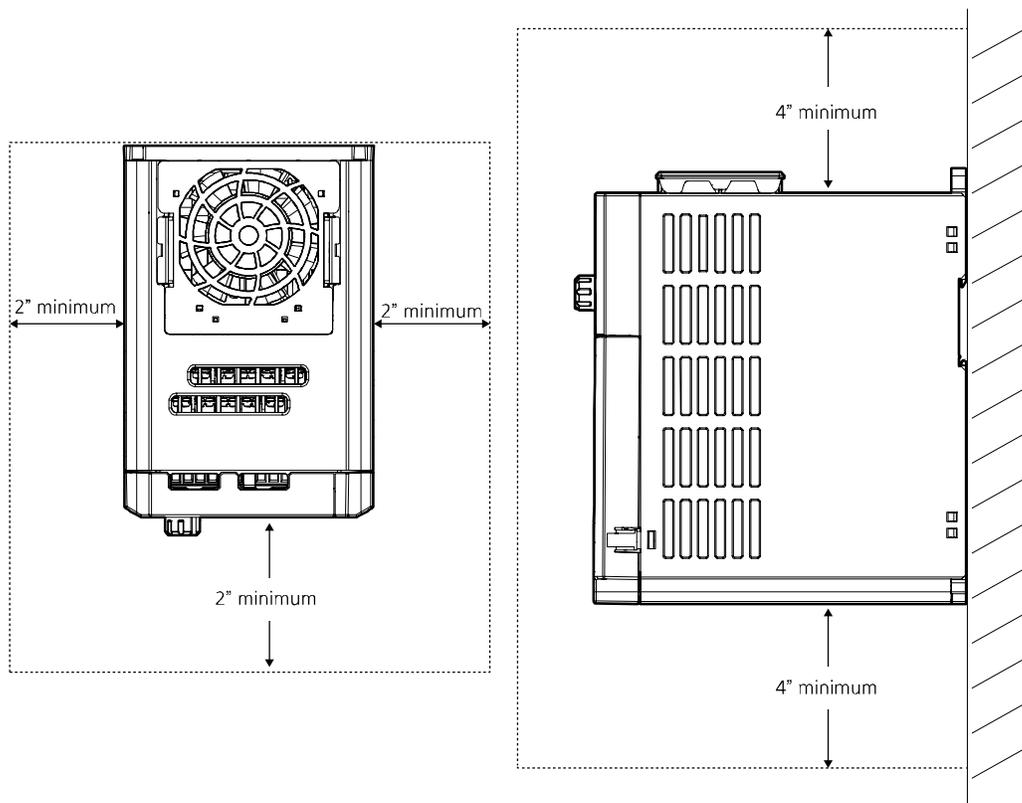
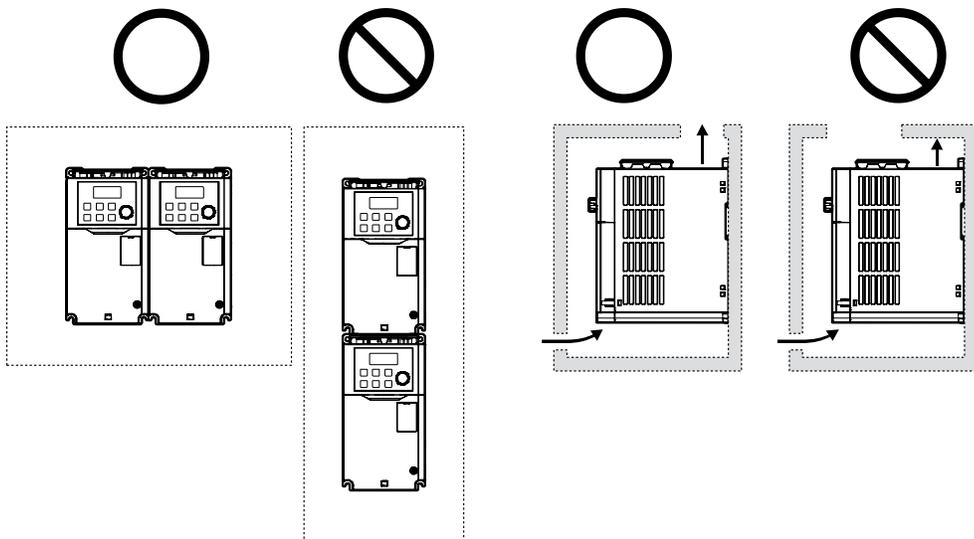
- Operation at 60Hz and room temperature
- 100% load
- Carrier Frequency (Default value)



IronHorse ACG Series Mounting Clearances

ACG Mounting Clearances

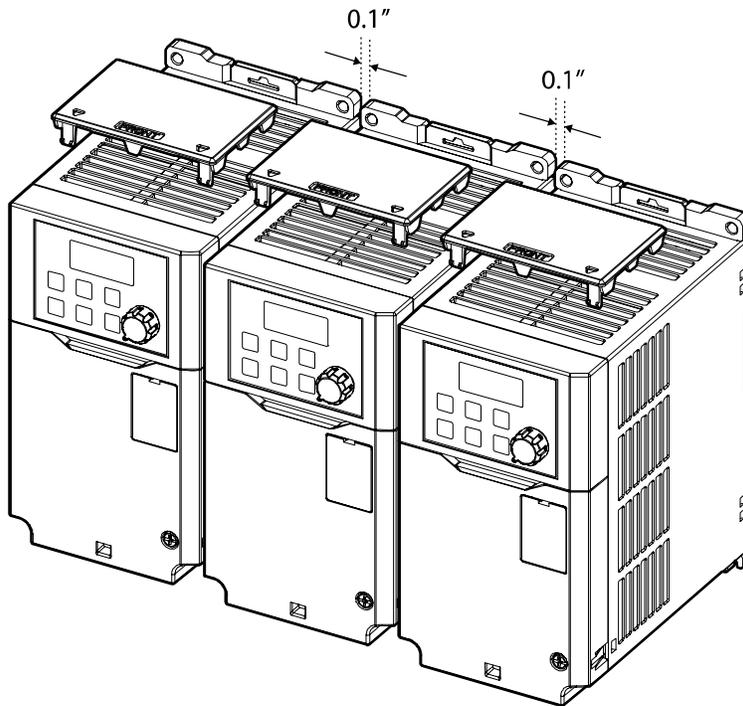
Ensure sufficient air circulation is provided around the drive when it is installed. If the drive is to be installed inside a panel, enclosure, or cabinet rack, carefully consider the position of the drive's cooling fan and the ventilation louver. Cooling fans must be positioned to efficiently transfer the heat generated by the operation of the drive.



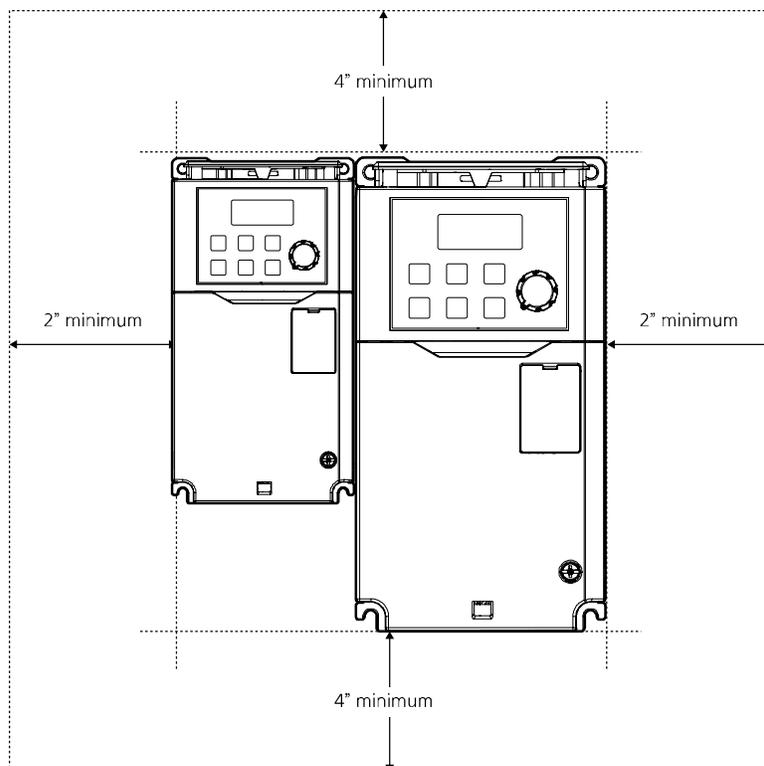


IronHorse ACG Series Mounting Clearances

If you are installing multiple drives in one location, arrange them side-by-side and remove the top covers. The top covers **MUST** be removed for side-by-side installations. Use a flat-head screwdriver to remove the top covers.



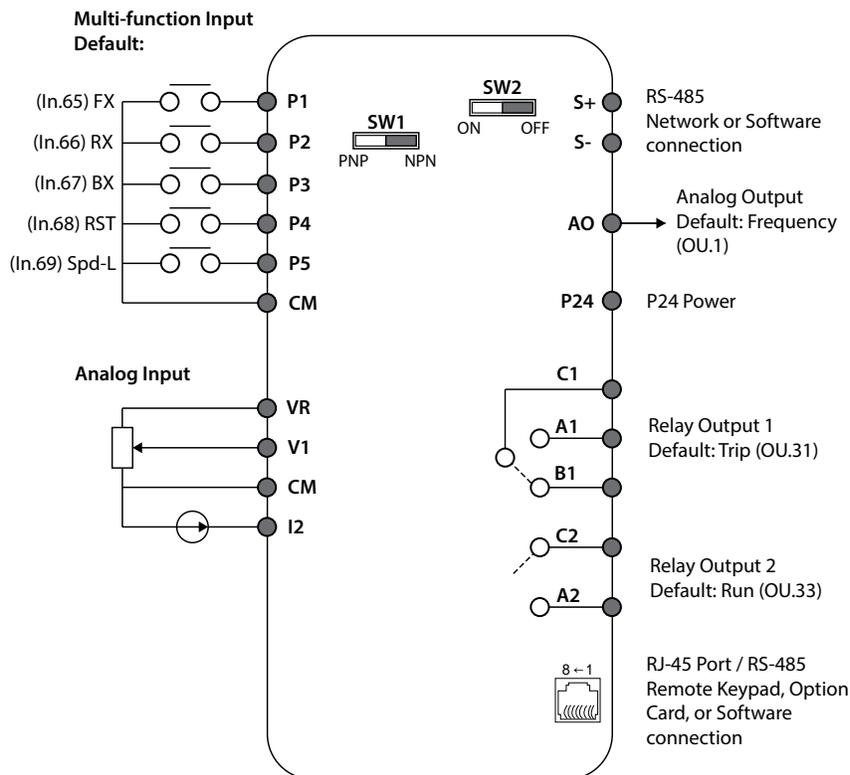
If you are installing multiple drives of different ratings, provide sufficient clearance to meet the clearance specifications of the larger drive.





IronHorse ACG Series I/O Diagram

ACG System I/O Diagram



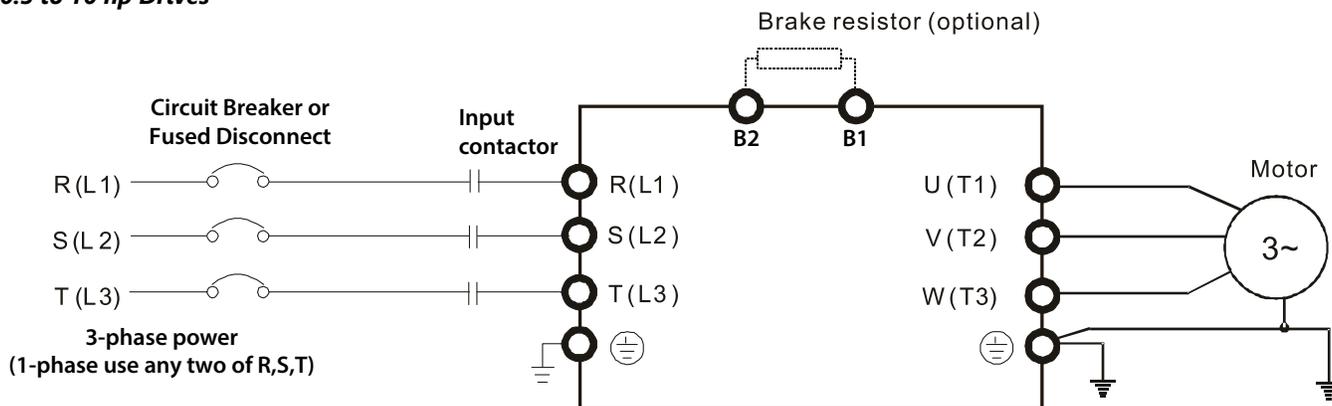
I/O Details			
Function	Label	Name	Description
Multi-function Digital Input Terminal Configuration	P1-P5	Multi-function Input 1-5	Configurable for multi-function input terminals. Factory default terminals and setup are as follows: <ul style="list-style-type: none"> • P1: FX (Forward Run) • P2: RX (Reverse Run) • P3: BX (Block) • P4: RST (Reset) • P5: Speed-L
	CM	Common Sequence	Common terminal for terminal input, RS-485 communication, and analog 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. <ul style="list-style-type: none"> • Maximum Voltage Output: 12V • Maximum Current Output: 100mA • Potentiometer: 1-5kΩ
	V1	Voltage input for control reference	Used to setup or modify a frequency reference via analog voltage input terminal. <ul style="list-style-type: none"> • Unipolar: 0-10V (12V Max.) • Bipolar: -10-10V (±12V Max.)
	I2	Voltage/current input for control reference	Used to setup or modify a frequency reference via the I2 terminal. <ul style="list-style-type: none"> • Input current: 4-20mA • Maximum Input current: 20mA • Input resistance: 249Ω
Analog Output	AO	Voltage/Current Output	Used to send inverter output information to external devices: output frequency, output current, output voltage, or a DC voltage. <ul style="list-style-type: none"> • Output voltage: 0-10V • Maximum output voltage/current: 12V/10mA • Factory default output: Frequency
Digital Relay Output	24	Internal 24V power source	Maximum output current: 100mA
	A1/C1/B1	Fault signal output 1	Sends out alarm signals when the inverter's safety features are activated (250VAC <1A, 30VDC < 1A). <ul style="list-style-type: none"> • Fault condition: A1 and C1 contacts are connected (B1 and C1 open connection) • Normal operation: B1 and C1 contacts are connected (A1 and C1 open connection)
	A2/C2	Fault signal output 2	Sends out alarm signals when the inverter's safety features are activated (250VAC <1A, 30VDC < 1A). <ul style="list-style-type: none"> • Fault condition: A2 and C2 contacts are open connection • Normal operation: A2 and C2 contacts are connected
Communication	S+/S-	RS-485 signal line	Used for network or software connection
	RJ45 Port	RS-485 signals	Remote keypad, option card, or software connection



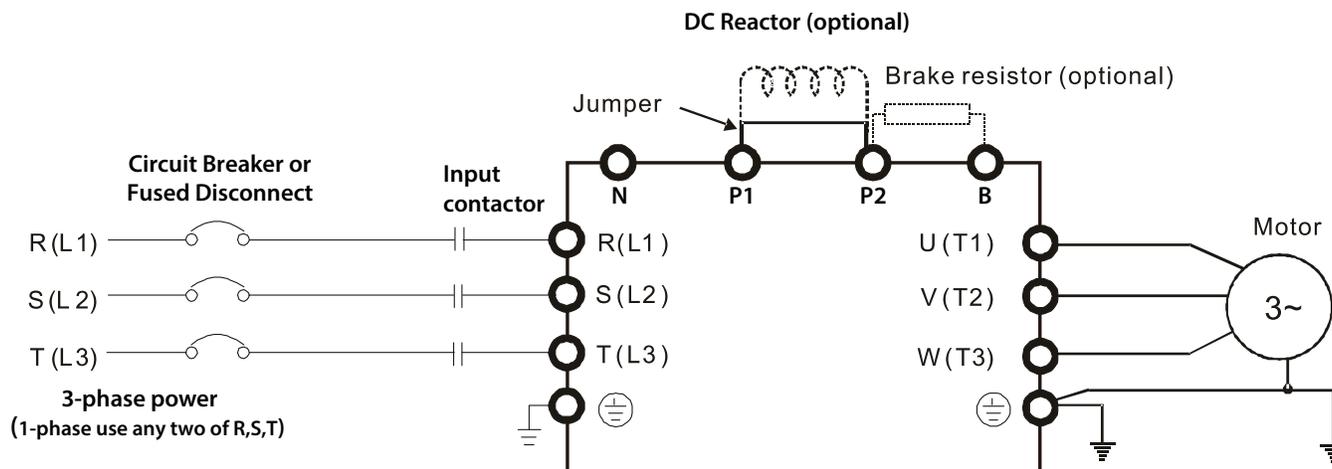
IronHorse ACG Series Basic Wiring

Main Circuit Wiring Diagram

0.5 to 10 hp Drives



15 to 30 hp Drives



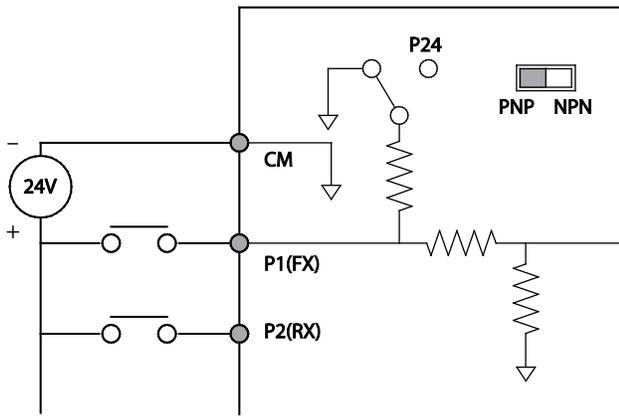
Power Terminal Labels and Descriptions		
Function	Name	Description
R(L1)/S(L2)/T(L3)	AC power input terminal	Mains supply AC power connections.
P2(+)/N(-)	DC input terminal	DC voltage terminals for 15-30 hp drives.
P1(+)/P2(+)	DC reactor terminal	DC reactor wiring connection for 15-30 hp drives. (Remove the short-bar when you use the DC reactor).
B1/B2 (0.5 to 10 hp)	Brake resistor terminals	Brake resistor wiring connection.
P2(+)/B (15 to 30 hp)		
U/V/W	Motor output terminals	3-phase AC motor wiring connections.



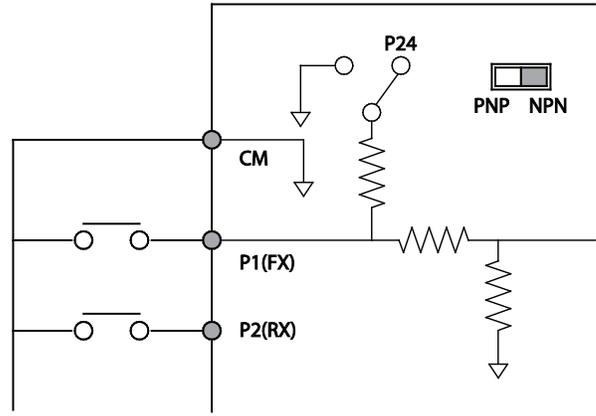
IronHorse ACG Series Basic Wiring

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	
	<p>2-wire control consists of maintained run signals. This can be accomplished via toggle switches, relays, jumpers, etc. Default parameters support this operation.</p> <p>P1=Forward Run (Fx) P2=Reverse Run (Rx) CM=Common</p>
3-Wire Control	
	<p>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.</p> <p>P1 = Forward Run (Fx) P2 = Reverse Run (Rx) P3 = Stop (3-Wire) CM = CommonFrequency Reference Wiring</p>

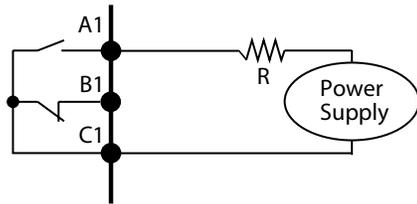


IronHorse ACG Series Basic Wiring

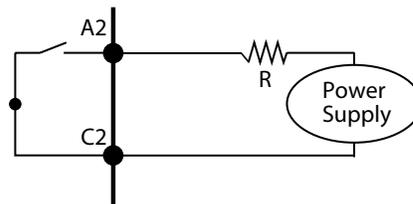
Digital Output Relay Wiring

NOTE: Ensure device current does not exceed 1A.

Relay 1

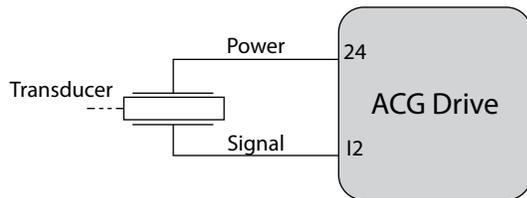


Relay 2

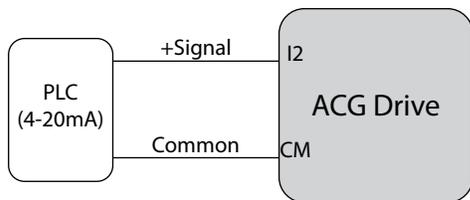


4-20mA Analog Input Wiring

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).

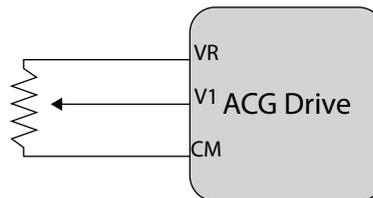


PLC (4-20mA): The wiring for connecting a PLC's 4-20mA output to the analog input of a VFD differs slightly from the transducer wiring discussed above. The positive (signal) lead is wired to the corresponding analog input while the negative (common) lead is wired to the drives common. Reference the figure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

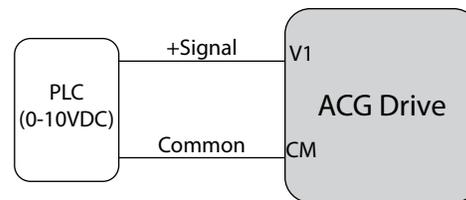


0-10VDC Analog Input Wiring

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.

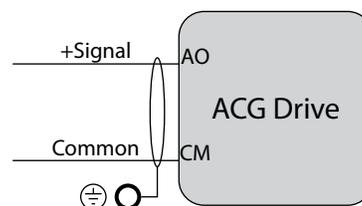


PLC (0-10VDC): The wiring for connecting a PLC's 0-10VDC output to the analog input of a VFD differs slightly from the speed POT wiring discussed above. The positive (signal) lead is wired to the corresponding analog input while the negative (common) lead is wired to the drives common. Reference the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



AO Wiring

Wire the drive analog out as follows:





IronHorse ACG Series Accessories

Accessories Available for ACG Drives

ACG Drives Available Software and Accessories	
<i>Accessory</i>	<i>Reference</i>
<i>Ethernet Module: ACG-ET2</i>	ACG Ethernet Module on page tIHA-16
<i>Conduit Boxes: ACG-N1A – ACG-N1F</i>	ACG Conduit Boxes on page tIHA-17
<i>Remote Keypad: ACG-KPD</i>	Remote Keypad on page tIHA-18
<i>Replacement Fans: ACG-FAN-A – ACG-FAN-FR45</i>	Replacement Fans on page tIHA-19
<i>Fuses/Circuit Breakers</i>	Fuses/Circuit Breakers on page tIHA-20
<i>EMI Filters</i>	High Performance EMI Input Filters on page tIHA-21
<i>Braking Resistors</i>	Braking Resistors on page tIHA-23
<i>Line Reactors/Voltage Time Filters</i>	Line Reactors/Voltage Time Filters on page tIHA-22
<i>VFD Suite</i>	VFD Suite on page tIHA-47



IronHorse ACG Series Accessories

ACG Ethernet Module

The ACG-ET2 is an option module for connecting any ACG series drive to an ethernet network. The module supports both the EtherNet/IP and Modbus TCP protocols.

ACG Ethernet Module		
Part Number	Price	Description
ACG-ET2	\$067ea:	IronHorse ACG series communication module, EtherNet/IP and Modbus TCP, 2 ports, (2) Ethernet (RJ45) and (1) RS-485 (RJ45) port(s). For use with IronHorse ACG series AC drives. Mounting hardware included.



ACG-ET2



Installed on ACG Drive



IronHorse ACG Series Accessories

ACG Conduit Boxes

The ACG conduit boxes allow conversion of the ACG drive to a NEMA1 rating.

ACG Conduit Boxes			
Part Number	Price	Description	Drawing Links
ACG-N1A	\$67ed:	IronHorse ACG series conduit box, NEMA 1. For use with ACG series A frame AC drives. Mounting hardware included.	PDF
ACG-N1B	\$67ee:	IronHorse ACG series conduit box, NEMA 1. For use with ACG series B frame AC drives. Mounting hardware included.	PDF
ACG-N1C	\$67ef:	IronHorse ACG series conduit box, NEMA 1. For use with ACG series C frame AC drives. Mounting hardware included.	PDF
ACG-N1D	\$67eg:	IronHorse ACG series conduit box, NEMA 1. For use with ACG series D frame AC drives. Mounting hardware included.	PDF
ACG-N1E	\$67eh:	IronHorse ACG series conduit box, NEMA 1. For use with ACG series E frame AC drives. Mounting hardware included.	PDF
ACG-N1F	\$67ec:	IronHorse ACG series conduit box, NEMA 1. For use with ACG series F frame AC drives. Mounting hardware included.	PDF



[ACG-N1A](#)



IronHorse ACG Series Accessories

Remote Keypad

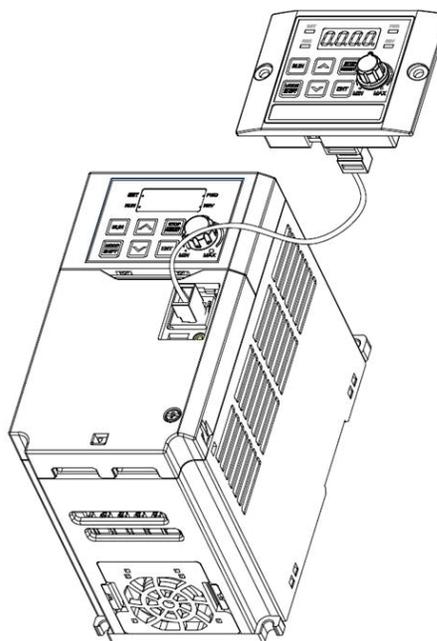
The ACG-KPD keypad allows for remote mounting of the standard keypad functionality for the ACG series drives.

The keypad can be mounted on an external panel or enclosure and connected to the drive by standard ethernet patch cable.

ACG Remote Keypad			
Part Number	Price	Description	Drawing Links
ACG-KPD	\$67eb:	IronHorse ACG series remote keypad, for use with IronHorse ACG series AC drives. (1) 16.4ft/5m Ethernet patch cable included.	PDF



ACG-KPD





IronHorse ACG Series Accessories

Replacement Fans

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

ACG Replacement Fans			
Part Number	Price	Description	Drawing Links
<u>ACG-FAN-A</u>	\$67e5:	IronHorse ACG series main cooling fan, replacement, 40 x 40 x 15mm, 24 VDC. For use with ACG series 1/2hp - 1hp AC drives.	<u>PDF</u>
<u>ACG-FAN-BC</u>	\$67e6:	IronHorse ACG series main cooling fan, replacement, 60 x 60 x 25mm, 24 VDC. For use with ACG series 2hp - 5hp AC drives.	<u>PDF</u>
<u>ACG-FAN-D</u>	\$67e7:	IronHorse ACG series main cooling fan, replacement, 60 x 60 x 25mm, 24 VDC. For use with ACG series 7-1/2hp - 10hp AC drives.	<u>PDF</u>
<u>ACG-FAN-E15</u>	\$67e8:	IronHorse ACG series main cooling fan, replacement, 80 x 80 x 25mm, 24 VDC. For use with ACG series 15hp AC drives.	<u>PDF</u>
<u>ACG-FAN-E20F</u>	\$67e9:	IronHorse ACG series main cooling fan, replacement, 92 x 92 x 38mm, 24 VDC. For use with ACG series 20hp - 30hp AC drives.	<u>PDF</u>



[ACG-FAN-A](#)



[ACG-FAN-BC](#)



[ACG-FAN-D](#)



[ACG-FAN-E15](#)



[ACG-FAN-E20F](#)



IronHorse ACG Series Accessories

Fuses/Circuit Breakers

Protection devices are essential to prevent damage to your ACG drive and application equipment. Please use the fuse specification chart below to select fuses that are applicable to your ACG 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*
ACG-20P5	200-240	0.5	10	ECSR10	15	UTE100H
ACG-21P0		1	10	ECSR10	15	
ACG-22P0		2	15	ECSR15	15	
ACG-23P0		3	20	ECSR20	20	
ACG-25P0		5	30	ECSR30	30	
ACG-27P5		7.5	50	ECSR50	50	UTS150H
ACG-2010		10	60	ECSR60	60	
ACG-2015		15	80	ECSR80	80	
ACG-2020		20	100	ECSR100	100	
ACG-40P5		380-480	0.5	10	ECSR10	
ACG-41P0	1		10	ECSR10	6.3	
ACG-42P0	2		10	ECSR10	12	
ACG-43P0	3		15	ECSR15	12	
ACG-45P0	5		20	ECSR20	20	
ACG-47P5	7.5		30	ECSR30	32	
ACG-4010	10		35	ECSR35	32	
ACG-4015	15		50	ECSR50	50	
ACG-4020	20		60	ECSR60	60	
ACG-4025	25		70	ECSR70	70	
ACG-4030	30	100	ECSR100	90		

* 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 ACG 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 ACG Series Accessories

High Performance EMI Input Filters

The optional accessories below are available for use with the ACG 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 (HD)	Roxburgh Filters Chassis Type 1ph *1	Roxburgh High Performance Filters *2	Roxburgh Max Performance Filters *3
ACG-20P5	200-240	0.5	RES90F03	KMF306A	MIF310
ACG-21P0		1	RES90F10	KMF310A	MIF310
ACG-22P0		2	RES90F16	KMF318A	MIF316
ACG-23P0		3	RES90F16	KMF318A	MIF316
ACG-25P0		5	RES90S20	KMF325A	MIF323
ACG-27P5		7.5	-	KMF336A	MIF350
ACG-2010		10	-	KMF350A	MIF350
ACG-2015		15	-	KMF370A	MIF375
ACG-2020		20	-	KMF3100A	MIF3100
ACG-40P5		380-480	0.5	-	KMF306A
ACG-41P0	1		-	KMF306A	MIF310
ACG-42P0	2		-	KMF306A	MIF310
ACG-43P0	3		-	KMF310A	MIF310
ACG-45P0	5		-	KMF318A	MIF316
ACG-47P5	7.5		-	KMF318A	MIF323
ACG-4010	10		-	KMF336A	MIF330B
ACG-4015	15		-	KMF336A	MIF350
ACG-4020	20		-	KMF350A	MIF350
ACG-4025	25		-	KMF350A	MIF350
ACG-4030	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 ACG 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 or any applications where reduced reflected waves is needed.

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	
ACG-20P5	200-240	0.5	2.2	2.5	LR2-20P5	LR2-20P2	LR2-20P5	LR2-20P2	VTF-246-CFG	VTF-46-DE	*
ACG-21P0		1	4.9	5.0	LR2-21P0	LR2-21P0	LR2-21P0	LR2-20P5	VTF-24-FH	VTF-246-CFG	
ACG-22P0		2	8.4	8.0	LR-23P0	LR-25P0	LR2-22P0	LR2-22P0	VTF-246-GJJ	VTF-24-FH	
ACG-23P0		3	11.8	11.0	LR-23P0	LR-23P0	LR2-22P0	LR2-22P0	VTF-4-M	VTF-246-GJJ	
ACG-25P0		5	18.5	17.0	LR-25P0	LR-2010	LR-25P0	LR2-22P0	VTF-46-LM	VTF-246-HKL	
ACG-27P5		7.5	25.8	24.0	LR-2010	LR-2015	LR-27P5	LR-25P0	VTF-246-KMN	VTF-24-JL	
ACG-2010		10	34.9	32.0	LR-2015	LR-2020	LR-2010	LR-25P0	VTF-246-LPQ	VTF-46-LM	
ACG-2015		15	53	47	LR-2020	LR-2030	LR-2015	LR-2010	VTF-246-NRS	VTF-46-NP	0.95/61
ACG-2020		20	68	60	LR-2025	LR-2040	LR-2020	LR-2010	VTF-246-PSU	VTF-246-LPQ	0.70/75
ACG-40P5	380-480	0.5	1.1	1.3	LR2-40P5				VTF-46-DE		*
ACG-41P0		1	2.4	2.5	LR2-41P0				VTF-246-CFG		
ACG-42P0		2	4.2	4.0	LR2-42P0				VTF-246-DGH		
ACG-43P0		3	5.9	5.5	LR2-43P0				VTF-24-FH		
ACG-45P0		5	9.8	9.0	LR2-45P0				VTF-46-DE		
ACG-47P5		7.5	12.9	12.0	LR2-47P5				VTF-46-DE		
ACG-4010		10	17.5	16.0	LR-4010				VTF-24-JL		
ACG-4015		15	27	24	LR-4015				VTF-246-KMN		1.90/32
ACG-4020		20	35	31	LR-4020				VTF-246-LPQ		1.40/41
ACG-4025		25	44	39	LR-4025				VTF-246-MQR		1.00/49
ACG-4030		30	51	45	LR-4030				VTF-246-MQR		0.70/64

* Only drives from 11–22 kW support DC reactors.

** NEMA1 filter versions are available. Use same PN with suffix -N1.



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

Note: Where noted on resistor quantity, S = series wiring, P = parallel wiring.

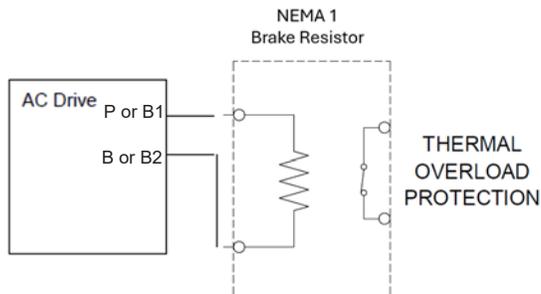
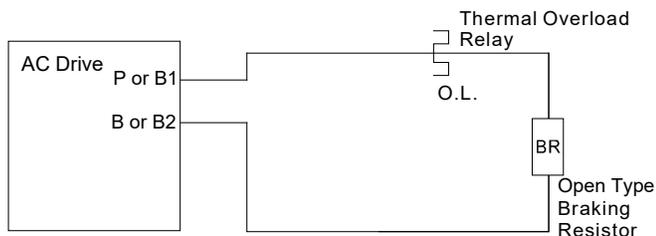


IronHorse ACG Series Accessories

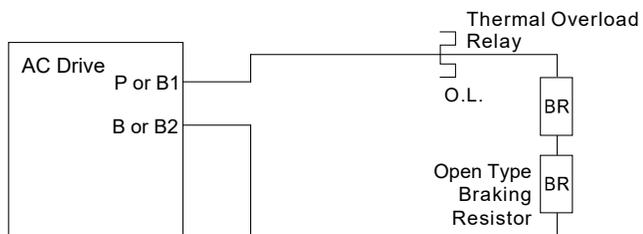
Brake Wiring

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.

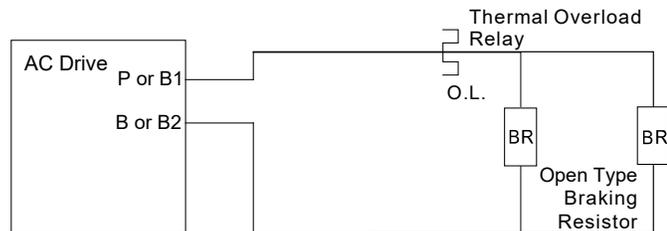
Drive + 1 Resistor or NEMA1 Resistor:



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
<u>ACN-232C</u>	\$;048tk:	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