

ACNACDRIVEUSERMANUALTABLEOFCONTENTS



ACN USER MANUAL TOC

WARNINGS AND TRADEMARKS	W-1
~ WARNING ~	W-1
Trademarks.	W-1
~ AVERTISSEMENT ~	W-2
Marques de commerce	W-2
Warnings	W-3
ACN SERIES DRIVES MANUAL REVISION HISTORY	H-1
ACN AC DRIVE USER MANUAL TABLE OF CONTENTS	TOC-1
CHAPTER 1: GETTING STARTED	1-1
User Manual Overview	1-2
Overview of this Publication	1-2
Who Should Read This Manual.	1-2
Supplemental Publications	1-2
Technical Support	1-2
Special Symbols	1-2
Purpose of AC Drives	1-3
Selecting the Proper Drive Rating	1-3
Determine Motor Full-Load Amperage (FLA)	1-3
Determine Motor Overload Requirements	1-3
Determine Application Type; Constant Torque or Variable Torque	1-3
Parts Locator	1-4
Continuous Rated Current Derating	1-5
Heat Emission	1-7
Watt Loss and Efficiency	1-7
IRONHORSE ACN Series AC Drive Environmental Information.	1-7
Storage and Transportation.	1-7
Environmental Conditions	1-8
IRONHORSE ACN SERIES AC Drive Specifications.	1-9
230V Class – (Model Specifications)	1-9
230V Class – (Model Specifications)	1-10
460V Class – (Model Specifications)	1-11
460V Class – (Model Specifications)	1-12
Specifications Applicable to All ACN Series Models	1-13
Receiving and Inspection	1-15
Drive Package Contents.	1-15
Model Number Explanation	1-16
Nameplate Information.	1-16
CHAPTER 2: INSTALLATION AND WIRING.	2-1
Drive Models by Frame Size	2-3

Installation	2-3
Basic Configuration Diagram	2-3
Installation Considerations	2-4
Minimum Clearances and Air Flow	2-4
Dimensions	2-5
Mounting the Drive	2-6
Removing Front Cover	2-8
Cable Wiring	2-9
Floating Ground System	2-10
Cable Selection	2-11
Ground Cable and Power Cable Specifications	2-11
Control (signal) Cable Specifications	2-12
Ground Connection	2-12
Power Terminal Wiring	2-13
0.5 – 1 HP (3-phase)	2-13
2.0 – 3.0 HP (3-phase)	2-13
5 HP (3-phase)	2-14
7.5 – 30 HP (3-phase)	2-14
Main Circuit Wiring Diagram (all frames)	2-15
Power Terminal Labels and Descriptions	2-15
Terminals for Connecting DC Reactor, External Brake Resistor, and DC Circuit	2-15
Wiring Guidelines	2-16
Motor Operation Precautions	2-16
Single Phase Input Utility Wiring and Operation	2-17
Power (HP), Input Current and Output Current	2-18
Input Frequency and Voltage Tolerance	2-18
Protection	2-18
Control Terminal Wiring	2-19
Control Board Switches	2-19
Connector	2-19
Input Terminal Labels and Descriptions	2-21
Output/Communication Terminal Labels and Descriptions	2-22
Pre-insulated Crimp Terminal Connectors (Bootlace Ferrule)	2-23
PNP/NPN Mode Wiring and Selection	2-24
PNP Mode (Source)	2-24
NPN Mode (Sink)	2-25
Run Command Wiring	2-25
Digital Output Wiring	2-26
Analog Wiring	2-26
AO Wiring	2-28
System Wiring Diagram	2-28
Re-assembling the Cover	2-28
Post-Installation Checklist	2-29
Test Run	2-30
Verifying the Motor Rotation	2-31
CHAPTER 3: KEYPAD OPERATION AND QUICK START	3-1
Learning to Perform Basic Operations	3-2
About the Keypad	3-2
Learning to Use the Keypad	3-5
Actual Application Examples	3-10

Monitoring the Operation	3-17
CHAPTER 4: AC DRIVE PARAMETERS.	4-1
AC Drive Parameters	4-3
Bit Selection	4-3
Parameter Table Format Explanation.	4-3
Operation Parameter Group	4-5
DRIVE Parameter Group (dr, DRV)	4-7
BASIC Parameter group (bA, BAS)	4-12
ADVANCED Parameter group (Ad, ADV).	4-17
CONTROL Parameter Group (Cn, CON)	4-21
INPUT Parameter Group (In, IN)	4-27
OUTPUT Parameter Group (OU, OUT)	4-32
COMMUNICATION Parameter Group (Cm, COM)	4-35
APPLICATION Parameter Group (AP , APP)	4-40
Extension IO Parameter Group (AO , APO)	4-43
PROTECTION Parameter Group (Pr, PRT).	4-46
2nd MOTOR Parameter Group (m2, M2).	4-50
USER SEQUENCE Parameter Group (US, USS).	4-52
USER SEQUENCE FUNCTION Parameter Group (UF , USF)	4-55
Trip Mode (TRP Last-x)	4-60
Config Mode (CNF)	4-61
IronHorse® ACN Drive Operation and Parameter Details	4-64
Chart Key	4-64
Learning Basic Features	4-65
Setting Frequency Reference	4-67
Frequency Hold by Analog Input.	4-75
Changing the Displayed Units (Hz↔Rpm)	4-76
Setting Multi-step Frequency.	4-76
Command Source Configuration.	4-78
Local/Remote Mode Switching.	4-81
Forward or Reverse Run Prevention	4-83
Power-on Run	4-84
Reset and Restart	4-85
Setting Acceleration and Deceleration Times	4-86
Acc/Dec Pattern Configuration	4-90
Stopping the Acc/Dec Operation.	4-91
V/F (Voltage/Frequency) Control.	4-92
Torque Boost	4-95
Output Voltage Setting	4-96
Start Mode Setting	4-96
Stop Mode Setting.	4-97
Frequency Limit	4-100
2nd Operation Mode Setting.	4-102
Multi-function Input Terminal Control.	4-103
P2P Setting.	4-104
Multi-keypad Setting	4-105
User Sequence Setting	4-106
Fire Mode Operation	4-121
Improvement of output voltage drop	4-122
Learning Advanced Features	4-123
Operating with Auxiliary References	4-124

Jog operation	4-127
Up-down Operation.	4-130
3-Wire Operation	4-132
Safe Operation Mode	4-133
Dwell Operation	4-134
Slip Compensation Operation	4-136
PID Control.	4-137
Auto Tuning	4-144
Sensorless Vector Control for Induction Motors	4-146
Sensorless Vector Control for PM (Permanent-Magnet) Synchronous Motors.	4-152
Kinetic Energy Buffering Operation	4-159
Torque Control.	4-161
Energy Saving Operation	4-165
Speed Search Operation	4-166
Auto Restart Settings	4-169
Operational Noise Settings (carrier frequency settings)	4-170
2nd Motor Operation	4-171
Supply Power Transition.	4-172
Cooling Fan Control	4-173
Input Power Frequency and Voltage Settings	4-174
Read, Write, and Save Parameters	4-174
Parameter Initialization (Reset to Defaults)	4-174
Parameter View Lock	4-175
Parameter Lock	4-176
Changed Parameter Display	4-177
User Group.	4-177
Easy Start On.	4-178
Config(CNF) Mode.	4-179
Multi-function IO Timer Settings.	4-180
Brake Control.	4-181
Multi-Function Output On/Off Control	4-182
Press Regeneration Prevention.	4-182
Analog Output.	4-183
Digital Output	4-187
Keypad Language Settings	4-191
Operation State Monitor	4-192
Operation Time Monitor	4-194
Learning Protection Features.	4-195
Motor Protection	4-195
Drive and Sequence Protection.	4-201
Dynamic Braking.	4-204
Under load Fault Trip and Warning.	4-206
Fault/Warning List	4-210
CHAPTER 5: SERIAL COMMUNICATIONS	5-1
Serial RS-485 Communication Features	5-2
Communication Standards	5-2
Common Third-Party Modbus RTU Masters.	5-2
AutomationDirect PLCs as Modbus Master	5-3
RS-232C to RS-485 Conversion.	5-4
Communication Protocol	5-12
Drive Expansion Common Area Parameter	5-15

<i>Drive Parameter Modbus Communication Addresses</i>	5-24
CHAPTER 6: MAINTENANCE AND TROUBLESHOOTING	6-1
<i>Operations Lockout</i>	6-2
<i>Maintenance and Inspections</i>	6-3
<i>Monthly Inspection</i>	6-3
<i>Annual Inspection</i>	6-3
<i>Recharge Capacitors (for drives not in service)</i>	6-3
<i>Recommended Inspection Schedules</i>	6-4
<i>Storage and Disposal</i>	6-7
<i>Troubleshooting</i>	6-8
<i>Trips and Warnings</i>	6-8
<i>Fault Trips</i>	6-8
CHAPTER 7: VFD SUITE SOFTWARE	7-1
<i>Getting Started</i>	7-2
<i>VFD Suite Characteristics</i>	7-2
<i>System Configuration</i>	7-2
<i>System Requirements</i>	7-2
<i>Prepare Installation</i>	7-2
<i>Key Features</i>	7-6
<i>Main Screen</i>	7-6
<i>Starting</i>	7-6
<i>Communication</i>	7-7
<i>Options</i>	7-7
<i>Project</i>	7-9
<i>Project Configuration</i>	7-9
<i>Project Management</i>	7-9
<i>Project Item</i>	7-11
<i>Online</i>	7-28
<i>Connection Option</i>	7-28
<i>Connect/End Connection</i>	7-30
<i>Write</i>	7-30
<i>Read</i>	7-30
<i>Drive Control</i>	7-31
<i>EEPROM Save</i>	7-31
<i>Other Screens</i>	7-32
<i>Event</i>	7-32
<i>Trip</i>	7-33
<i>Specialized Features</i>	7-34
<i>User Sequence</i>	7-34
<i>Wizard</i>	7-37
APPENDIX A: ACCESSORIES	A-1
<i>Fuses/Circuit Breakers</i>	A-2
<i>High Performance EMI Input Filters</i>	A-3
<i>EMI Filter Installation</i>	A-3
<i>Recommended Motor Cable Length</i>	A-5
<i>Line Reactors / Voltage Time Filters</i>	A-6
<i>Line Reactor</i>	A-6
<i>Load Reactor/Voltage Time Filter</i>	A-6
<i>DC Reactor</i>	A-7
<i>Line/Load Reactors and Output Filters Selection Charts</i>	A-8

Line Reactor Applications and Wiring Connections	A-8
Recommended Cable Length	A-11
Dynamic Braking	A-12
Braking Units	A-12
Choosing and Installing a Braking Resistor	A-13
<u>ACN-232C IronHorse ACN 232 USB to RJ45 Port Cable</u>	A-14
<u>ACN-LCD Remote LCD Keypad</u>	A-15
About the Keypad	A-15
Menu Items	A-18
Navigating Modes	A-19
Navigating Modes and Parameters	A-22
Navigating through Codes (Function Items)	A-25
Setting Parameters	A-28
Monitoring Operating Status	A-30
Monitoring Faults	A-33
Initializing Parameters	A-36
Parameter Lock (LCD)	A-37
<u>ACN-3MRC LCD Keypad Mount Kit and Cable</u>	A-38
<u>ACN-LCDKM Remote LCD Keypad NEMA4X Mounting Kit and Cable</u>	A-39
Installation Procedure	A-39
APPENDIX B: OPTIONAL I/O CARD	B-1
Basic Information	B-2
Characteristics	B-2
Components	B-2
Specifications	B-3
Input and Output Specification	B-3
Installation	B-4
Installation of ACN I/O Card	B-4
Control Terminal Wiring	B-6
Signal (Control) Cable Specifications	B-8
Parameter Configuration	B-10
Basic Features	B-10
Basic Function	B-10
Setting Frequency Reference	B-10
Analog Output	B-17
Digital Output	B-19
Setting Multi-step Frequency	B-23
Multi-step Acc/Dec Time Configuration	B-25
Stopping the Acc/Dec Operation	B-26
Multi-function Input Terminal Control	B-27
APPENDIX C: ETHERNET MODULE ACN-ETH	C-1
Ethernet/Modbus Card Quick Start	C-3
Hardware	C-3
Parameters	C-4
Introduction	C-5
ACN-ETH Module	C-5
Components	C-5
Ethernet Communication Module Features	C-6
Common Features	C-6
Layout of Ethernet Communication Module	C-6

Installation	C-7
Terminal Block of Ethernet communication Specifications	C-9
Network Cable Specification	C-10
Protocol Selection	C-10
LED information	C-11
LED display feature	C-11
Ethernet Line LED (EtherNet/IP and Modbus TCP are same)	C-11
Modbus TCP LED & Troubleshooting	C-11
EtherNet/IP LED & Troubleshooting	C-12
Keypad Parameter of Ethernet Communication	C-13
FBus S/W Ver (CM.06)	C-13
FBus Led (CM.09)	C-13
IP Address, Subnet Mask, Gateway (CM.10~21) Setting	C-14
Ethernet Speed (CM.22)	C-14
CIP Input Instance (CM.29)	C-15
CIP Output Instance(CM.49)	C-16
Number of Output Parameters (CM.30)	C-16
Parameter Status (CM.31~CM.38)	C-17
Number of Input Parameters (CM.50)	C-17
Parameter Control (CM.51~CM.58)	C-17
Comm Update (CM.94)	C-17
Modbus TCP	C-18
Modbus TCP Frame Structure.	C-18
Function Code Description	C-18
Read Holding Register.	C-18
Read Input Register	C-18
Write Single Register	C-19
Write Multiple Register	C-19
Except Frame.	C-20
Exception Frame Structure	C-20
Exception Code Type	C-20
EtherNet/IP.	C-21
Basic Protocol Configuration	C-21
Implicit Message.	C-22
Explicit Message	C-27
Supported Object	C-28
Lost Command	C-33
Drive Keypad Parameter.	C-33
APPENDIX D: SAFE TORQUE OFF	D-1
Introduction	D-2
Introduction	D-2
Terminal Configuration	D-2
Safe Torque Off Terminal Function Description	D-2
Operation Conditions Description	D-2
Wiring Diagrams.	D-3
Internal Sto Circuit.	D-3
Operating Sequence Description	D-3
Normal Operation Status	D-3
Safe Function Failure Rate	D-4
Safety Requirements Specification.	D-4

Installation Considerations D-4
Safe Function Performance D-4