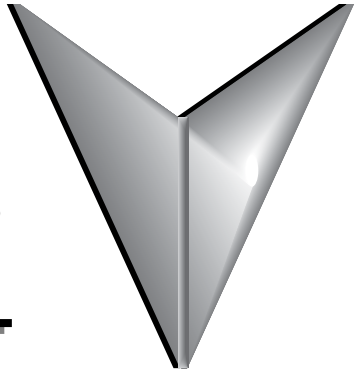
ACN AC Drive User Manual Table of Contents



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 Locater 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) . . . 4–41
Extension IO Parameter Group (AO , APO) . . . 4–44
PROTECTION Parameter Group (Pr, PRT) . . . 4–47
2nd MOTOR Parameter Group (m2, M2) . . . 4–51
USER SEQUENCE Parameter Group (US, USS) . . . 4–53
USER SEQUENCE FUNCTION Parameter Group (UF , USF) . . . 4–56
Trip Mode (TRP Last-x) . . . 4–61
Config Mode (CNF) . . . 4–62
IronHorse® ACN Drive Operation and Parameter Details . . . 4–65
Chart Key . . . 4–65
Learning Basic Features . . . 4–66
Setting Frequency Reference . . . 4–68
Frequency Hold by Analog Input . . . 4–76
Changing the Displayed Units (Hz↔Rpm) . . . 4–77
Setting Multi–step Frequency . . . 4–77
Command Source Configuration . . . 4–79
Local/Remote Mode Switching . . . 4–82
Forward or Reverse Run Prevention . . . 4–84
Power–on Run . . . 4–85
Reset and Restart . . . 4–86
Setting Acceleration and Deceleration Times . . . 4–87
Acc/Dec Pattern Configuration . . . 4–91
Stopping the Acc/Dec Operation . . . 4–92
V/F (Voltage/Frequency) Control . . . 4–93
Torque Boost . . . 4–96
Output Voltage Setting . . . 4–97
Start Mode Setting . . . 4–97
Stop Mode Setting . . . 4–98
Frequency Limit . . . 4–101
2nd Operation Mode Setting . . . 4–103
Multi–function Input Terminal Control . . . 4–104
P2P Setting . . . 4–105
Multi–keypad Setting . . . 4–106
User Sequence Setting . . . 4–107
Fire Mode Operation . . . 4–122
Improvement of output voltage drop . . . 4–123
Learning Advanced Features . . . 4–124
Operating with Auxiliary References . . . 4–125

Jog operation 4–128
Up–down Operation 4–131
3–Wire Operation 4–133
Safe Operation Mode 4–134
Dwell Operation 4–135
Slip Compensation Operation 4–137
PID Control 4–138
Auto Tuning 4–145
Sensorless Vector Control for Induction Motors 4–147
Sensorless Vector Control for PM (Permanent–Magnet) Synchronous Motors 4–153
Kinetic Energy Buffering Operation 4–160
Torque Control 4–162
Energy Saving Operation 4–166
Speed Search Operation 4–167
Auto Restart Settings 4–170
Operational Noise Settings (carrier frequency settings) 4–171
2nd Motor Operation 4–172
Supply Power Transition 4–173
Cooling Fan Control 4–174
Input Power Frequency and Voltage Settings 4–175
Read, Write, and Save Parameters 4–175
Parameter Initialization (Reset to Defaults) 4–175
Parameter View Lock 4–176
Parameter Lock 4–177
Changed Parameter Display 4–178
User Group 4–178
Easy Start On 4–179
Config(CNF) Mode 4–180
Multi-function IO Timer Settings 4–181
Brake Control 4–182
Multi–Function Output On/Off Control 4–183
Press Regeneration Prevention 4–183
Analog Output 4–184
Digital Output 4–188
Keypad Language Settings 4–192
Operation State Monitor 4–193
Operation Time Monitor 4–195
Learning Protection Features 4–196
Motor Protection 4–196
Drive and Sequence Protection 4–202
Dynamic Braking 4–205
Under load Fault Trip and Warning 4–207
Fault/Warning List 4–211
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 5–16

Drive Parameter Modbus Communication Addresses . . . 5–25
CHAPTER 6: MAINTENANCE AND TROUBLESHOOTING . . . 6–1
Operations Lockout . . . 6–2
Maintenance and Inspections . . . 6–3
Monthly Inspection . . . 6–3
Annual Inspection . . . 6–3
Recharge Capacitors (for drives not in service) . . . 6–3
Recommended Inspection Schedules . . . 6–4
Storage and Disposal . . . 6–7
Troubleshooting . . . 6–8
Trips and Warnings . . . 6–8
Fault Trips. . . . 6–8
APPENDIX A: ACCESSORIES . . . A–1
Fuses/Circuit Breakers. . . . A–2
High Performance EMI Input Filters . . . A–3
EMI Filter Installation . . . A–3
Recommended Motor Cable Length . . . A–5
Line Reactors / Voltage Time Filters . . . A–6
Line Reactor . . . A–6
Load Reactor/Voltage Time Filter. . . . A–6
DC Reactor . . . A–7
Line/Load Reactors and Output Filters Selection Charts . . . 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
ACN-232C IronHorse ACN 232 USB to RJ45 Port Cable . . . A–14
ACN-LCD Remote LCD Keypad . . . 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
ACN-3MRC LCD Keypad Mount Kit and Cable . . . A–38
ACN-LCDKM Remote LCD Keypad NEMA4X Mounting Kit and Cable . . . A–39
Installation Procedure . . . A–39
Replacement Cooling Fans . . . A–43
VFD Suite. . . . A–44
Connecting to VFD Suite . . . A–45
VFD Suite Serial Connection Setup. . . . A–46
VFD Suite Ethernet Connection Setup . . . A–48
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
STO Circuit when using external 24VDC power D–3
Operating Sequence Description D–4
Normal Operation Status D–4
Safe Function Failure Rate D–5
Safety Requirements Specification D–5
Installation Considerations D–5
Safe Function Performance D–5