

DURAPULSE GS4 AC DRIVE USER MANUAL TABLE OF CONTENTS



CONTENTS

GS4 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
DURAPULSE GS4 USER MANUAL REVISION HISTORY	H-1
DURAPULSE GS4 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
Installation Altitude	1-4
Determine Maximum Enclosure Internal Temperature	1-5
Derate Output Current Based on Carrier Frequency (if necessary)	1-6
DURAPULSE GS4 AC Drive Environmental Information	1-9
Storage and Transportation.	1-9
Environmental Conditions	1-9
DURAPULSE GS4 AC Drive Specifications	1-10
230V Class – Constant Torque – (Model-Specific Specifications)	1-10
230V Class – Variable Torque – (Model-Specific Specifications)	1-12
460V Class – Constant & Variable Torque – (Model-Specific Specifications)	1-13
Specifications Applicable to All GS4 Models	1-15
Receiving and Inspection	1-16
Drive Package Contents.	1-16
Model Number Explanation	1-17
Nameplate Information.	1-17
Unpacking Your GS4 DURAPULSE AC Drive	1-18
Lifting Eye Locations and Instructions	1-18
Unpacking the Drive.	1-20

CHAPTER 2: INSTALLATION AND WIRING.	2-1
Drive Models by Frame Size	2-2
Installation	2-2
Minimum Clearances and Air Flow.	2-3
Minimum Clearance Distances	2-3
Airflow and Power Dissipation	2-6
Dimensions	2-7
Circuit Connections – RFI Jumper	2-14
RFI Jumper Removal.	2-14
Isolating Main Power from Ground	2-15
Floating Ground System (IT Systems)	2-16
Asymmetric Ground System (Corner Grounded TN Systems)	2-16
Circuit Connections – Warnings and Notes	2-17
Danger!.	2-17
Wiring Terminal Access	2-20
Control Terminal Access.	2-20
Removing the Control Terminal Block	2-21
Main Circuit Wiring Terminals	2-22
Main Terminal Specifications	2-22
Wiring Terminal Connector Dimensions – Main-Circuit Terminals.	2-24
Main Terminal Diagrams	2-28
Main Circuit Wiring Diagrams	2-30
Control Circuit Wiring Terminals	2-31
Control Terminal Specifications.	2-31
Control Terminal Block Diagram & Wiring Specifications	2-34
Control Terminal Wiring Instructions.	2-34
Control Circuit Wiring Diagrams	2-35
Digital Inputs.	2-35
Full I/O with Sinking Inputs	2-36
Full I/O with Sourcing Inputs	2-37
CHAPTER 3: KEYPAD OPERATION AND QUICKSTART.	3-1
The DURApulse GS4 Digital Keypad	3-2
GS4 Start-Up Display	3-4
Status Page.	3-4
Menu Page.	3-5
Quick-Start – Quick-Start Page	3-6
Keypad Fault Codes	3-16
GS4 Start-Up Display	3-4
Status Page.	3-4
Menu Page.	3-5
Quick-Start – Quick-Start Page	3-6
Keypad Fault Codes	3-16
Keypad Fault Codes	3-16
CHAPTER 4: AC DRIVE PARAMETERS	4-1
DURAPULSE GS4 Parameter Summary	4-2
Motor Parameters Summary (P0.xx)	4-2
Ramps Parameters Summary (P1.xx)	4-3
V/Hz Parameters Summary (P2.xx)	4-4

Digital Parameters Summary (P3.xx)	4-6
Analog Parameters Summary (P4.xx).	4-10
Presets Parameters Summary (P5.xx).	4-13
Protection Parameters Summary (P6.xx).	4-14
PID Parameters Summary (P7.xx).	4-18
Display Parameters Summary (P8.xx)	4-19
Serial Communication Parameters Summary (P9.xx)	4-22
Pump Parameters Summary (P10.xx).	4-26
Fault Parameters Summary (P11.xx)	4-27
DURAPULSE GS4 Parameter Details	4-30
Explanation of Parameter Details format	4-30
Group P0.xx Details – Motor Parameters	4-30
Group P1.xx Details – Ramps Parameters	4-36
Group P2.xx Details – V/Hz Parameters	4-46
Group P3.xx Details – Digital Parameters	4-60
Group P4.xx Details – Analog Parameters	4-89
Analog Input Parameter Examples	4-108
Group P5.xx Details – Presets Parameters	4-119
Group P6.xx Details – Protection Parameters	4-121
Group P7.xx Details – PID Parameters	4-160
Group P8.xx Details – Display Parameters	4-171
Group P9.xx Details – Serial Communication Parameters	4-178
Block Transfer Explanation	4-189
Group P10.xx Details – Pump Parameters	4-190
Pump Parameters Details	4-191
Timing Charts for Circulative Control Modes P10.01 through P10.08.	4-194
Terminal Specifications for GS4-06TR (Optional Six-Relay Output Card)	4-200
Wiring Diagrams for Cyclical Pump Control.	4-200
Group P11.xx Details – Fault Parameters.	4-203
Ramps Parameters Summary (P1.xx).	4-3
V/Hz Parameters Summary (P2.xx).	4-4
Digital Parameters Summary (P3.xx)	4-6
Analog Parameters Summary (P4.xx).	4-10
Presets Parameters Summary (P5.xx).	4-13
Protection Parameters Summary (P6.xx).	4-14
PID Parameters Summary (P7.xx).	4-18
Display Parameters Summary (P8.xx)	4-19
Serial Communication Parameters Summary (P9.xx)	4-22
Pump Parameters Summary (P10.xx).	4-26
Fault Parameters Summary (P11.xx)	4-27
DURAPULSE GS4 Parameter Details	4-30
Explanation of Parameter Details format	4-30
Group P0.xx Details – Motor Parameters	4-30
Group P1.xx Details – Ramps Parameters	4-36
Group P2.xx Details – V/Hz Parameters	4-46
Group P3.xx Details – Digital Parameters	4-60
Group P4.xx Details – Analog Parameters	4-89
Analog Input Parameter Examples	4-108
Group P5.xx Details – Presets Parameters	4-119

Group P6.xx Details – Protection Parameters	4-121
Group P7.xx Details – PID Parameters	4-160
Group P8.xx Details – Display Parameters	4-171
Group P9.xx Details – Serial Communication Parameters	4-178
Block Transfer Explanation	4-189
Group P10.xx Details – Pump Parameters	4-190
Pump Parameters Details	4-191
Timing Charts for Circulative Control Modes P10.01 through P10.08.	4-194
Terminal Specifications for GS4-06TR (Optional Six-Relay Output Card)	4-200
Wiring Diagrams for Cyclical Pump Control.	4-200
Group P11.xx Details – Fault Parameters.	4-203
V/Hz Parameters Summary (P2.xx).	4-4
Digital Parameters Summary (P3.xx).	4-6
Analog Parameters Summary (P4.xx).	4-10
Presets Parameters Summary (P5.xx).	4-13
Protection Parameters Summary (P6.xx).	4-14
PID Parameters Summary (P7.xx).	4-18
Display Parameters Summary (P8.xx)	4-19
Serial Communication Parameters Summary (P9.xx)	4-22
Pump Parameters Summary (P10.xx).	4-26
Fault Parameters Summary (P11.xx)	4-27
DURAPULSE GS4 Parameter Details	4-30
Explanation of Parameter Details format	4-30
Group P0.xx Details – Motor Parameters	4-30
Group P1.xx Details – Ramps Parameters	4-36
Group P2.xx Details – V/Hz Parameters	4-46
Group P3.xx Details – Digital Parameters	4-60
Group P4.xx Details – Analog Parameters	4-89
Analog Input Parameter Examples	4-108
Group P5.xx Details – Presets Parameters	4-119
Group P6.xx Details – Protection Parameters	4-121
Group P7.xx Details – PID Parameters	4-160
Group P8.xx Details – Display Parameters	4-171
Group P9.xx Details – Serial Communication Parameters	4-178
Block Transfer Explanation	4-189
Group P10.xx Details – Pump Parameters	4-190
Pump Parameters Details	4-191
Timing Charts for Circulative Control Modes P10.01 through P10.08.	4-194
Terminal Specifications for GS4-06TR (Optional Six-Relay Output Card)	4-200
Wiring Diagrams for Cyclical Pump Control.	4-200
Group P11.xx Details – Fault Parameters.	4-203
Protection Parameters Summary (P6.xx).	4-14
PID Parameters Summary (P7.xx).	4-18
Display Parameters Summary (P8.xx)	4-19
Serial Communication Parameters Summary (P9.xx)	4-22
Pump Parameters Summary (P10.xx).	4-26
Fault Parameters Summary (P11.xx)	4-27
DURAPULSE GS4 Parameter Details	4-30
Explanation of Parameter Details format	4-30

Group P0.xx Details – Motor Parameters	4-30
Group P1.xx Details – Ramps Parameters	4-36
Group P2.xx Details – V/Hz Parameters	4-46
Group P3.xx Details – Digital Parameters	4-60
Group P4.xx Details – Analog Parameters	4-89
Analog Input Parameter Examples	4-108
Group P5.xx Details – Presets Parameters	4-119
Group P6.xx Details – Protection Parameters	4-121
Group P7.xx Details – PID Parameters	4-160
Group P8.xx Details – Display Parameters	4-171
Group P9.xx Details – Serial Communication Parameters	4-178
Block Transfer Explanation	4-189
Group P10.xx Details – Pump Parameters	4-190
Pump Parameters Details	4-191
Timing Charts for Circulative Control Modes P10.01 through P10.08.	4-194
Terminal Specifications for GS4-06TR (Optional Six-Relay Output Card)	4-200
Wiring Diagrams for Cyclical Pump Control.	4-200
Group P11.xx Details – Fault Parameters.	4-203
CHAPTER 5: SERIAL COMMUNICATIONS	5-1
Communications Parameters Summary	5-2
Summary – Serial Communication Parameters	5-2
Summary – Block Transfer Parameters.	5-5
Serial Modbus Status Addresses	5-6
Status Addresses (Read Only).	5-6
Serial Communications Overview	5-8
Serial Communications Connectivity.	5-8
Minimum AC Drive Parameter Settings For Serial Communication	5-8
Common Third-Party Modbus RTU Masters.	5-9
AutomationDirect PLCs as Modbus Master	5-9
Connecting Communication Cables	5-10
Detailed Serial Modbus Communication Information	5-12
Data Format	5-12
Communication Protocol	5-13
CMD (command code) and DATA (data characters)	5-14
BACnet Serial Communication	5-18
About BACnet	5-18
Parameter Summary for BACnet	5-18
GS4 BACnet Object and Property	5-19
Steps to Setup the GS4 Parameters for BACnet.	5-23
BACnet Protocol Implementation Conformance Statement	5-24
CHAPTER 6: MAINTENANCE AND TROUBLESHOOTING.	6-1
Maintenance and Inspections	6-2
Monthly Inspection	6-2
Annual Inspection	6-2
Recharge Capacitors (for drives not in service)	6-3
Recommended Inspection Schedules	6-4
Troubleshooting.	6-8
Warning Codes.	6-8
Fault Codes.	6-16

Typical AC Drive Problems and Solutions	6-26
Grease and Dirt Problems.	6-26
Fiber Dust Problem	6-27
Corrosion Problem.	6-28
Industrial Dust Problem.	6-29
Wiring and Installation Problem	6-30
Digital Input/Output Terminal Problems.	6-31
CHAPTER 7: GSOFT2 – GETTING STARTED.	7-1
GS4 Drive Configuration Software	7-2
System Requirements	7-2
Installation Guide	7-3
System Requirement Configuration	7-3
Software Installation.	7-4
Opening GSoft2 Software Program	7-6
Software Functions	7-7
Firmware Upgrade Notes	7-10
GSoft2 Help File Note.	7-10
CHAPTER 8: GSLOGIC INTRODUCTION.	8-1
Purpose of This Chapter	8-2
For More Detailed Information.	8-2
GSLogic Introduction	8-2
GS4 PLC Summary.	8-3
Introduction	8-3
Notes on Using GSLogic, the GS4 PLC, and the GS4 Drive.	8-4
Getting Started	8-6
Connect to PLC.	8-6
Installation of GSLogic Programming Software.	8-9
System Requirements	8-9
About Getting Started.	8-9
Software and Online Help Files.	8-9
Technical Support	8-9
Installing GSLogic Programming Software	8-10
Program Writing.	8-12
Connecting GSLogic PC to GS4 PLC	8-12
Basic Ladder Program Example.	8-17
Program Download	8-19
Program Monitoring.	8-20
GS4 GSLogic Program Examples	8-21
APPENDIX A: ACCESSORIES	A-1
Line/Load Reactors	A-2
Line/Load Reactors Selection Charts.	A-2
Line/Load Reactor Specification Charts	A-4
DC Reactors (Choke) Specification Charts	A-6
Line Reactor Dimensions	A-7
Line Reactor Applications and Wiring Connections.	A-19
Drive Output Filters	A-22
VTF Part Number Explanation	A-22
VTF Specifications	A-23

Output Filter Dimensions – VTF Series	A-24
EMI Input Filters	A-30
EMI Filter Dimensions	A-31
EMI Filter Installation	A-33
Reflective Wave Phenomenon	A-34
Recommended Motor Cable Length	A-34
Motor Cable Length Charts	A-35
Fuses	A-36
Dynamic Braking	A-37
Braking Units	A-37
USB to RS-485 PC Adapter	A-38
USB-485M to GS4 Wiring and Pin-out	A-38
Conduit Box Kit	A-39
Conduit Box Installation – Frames D0 and D	A-40
Conduit Box Installation – Frame E	A-41
Conduit Box Installation – Frame F	A-42
Conduit Box Installation – Frame G	A-43
Flange Mounting Kits (Frames A, B, C)	A-45
Flange Mounting Kits – Frame A	A-45
Flange Mounting Kits – Frame B	A-48
Flange Mounting Kits – Frame C	A-50
Instructions for Built-in Flange Mounting (Frames D0, D, E, F)	A-52
Cutout Dimensions	A-52
Flange Mounting Instructions – Frames D0, D, E	A-53
Flange Mounting Instructions – Frame F	A-54
Spare Keypad	A-55
GS4-KPD	A-55
Keypad Panel Mounting Kit GS4-BZL	A-57
Spare Fan Kits	A-59
Fan Removal	A-62
DC Reactors (Choke) Specification Charts	A-6
Line Reactor Dimensions	A-7
Line Reactor Applications and Wiring Connections	A-19
Drive Output Filters	A-22
VTF Part Number Explanation	A-22
VTF Specifications	A-23
Output Filter Dimensions – VTF Series	A-24
EMI Input Filters	A-30
EMI Filter Dimensions	A-31
EMI Filter Installation	A-33
Reflective Wave Phenomenon	A-34
Recommended Motor Cable Length	A-34
Motor Cable Length Charts	A-35
Fuses	A-36
Dynamic Braking	A-37
Braking Units	A-37
USB to RS-485 PC Adapter	A-38
USB-485M to GS4 Wiring and Pin-out	A-38
Conduit Box Kit	A-39

Conduit Box Installation – Frames D0 and D	A-40
Conduit Box Installation – Frame E	A-41
Conduit Box Installation – Frame F	A-42
Conduit Box Installation – Frame G	A-43
Flange Mounting Kits (Frames A, B, C)	A-45
Flange Mounting Kits – Frame A	A-45
Flange Mounting Kits – Frame B	A-48
Flange Mounting Kits – Frame C	A-50
Instructions for Built-in Flange Mounting (Frames D0, D, E, F)	A-52
Cutout Dimensions	A-52
Flange Mounting Instructions – Frames D0, D, E	A-53
Flange Mounting Instructions – Frame F	A-54
Spare Keypad	A-55
GS4-KPD	A-55
Keypad Panel Mounting Kit GS4-BZL	A-57
Spare Fan Kits	A-59
Fan Removal	A-62
Keypad Panel Mounting Kit GS4-BZL	A-57
Spare Fan Kits	A-59
Fan Removal	A-62
APPENDIX B: OPTIONAL I/O AND COMMUNICATION CARDS	B-1
Introduction	B-2
Removing the Card Slot Cover	B-2
Option Card Installation and Removal	B-4
Installation	B-4
Removal	B-4
Optional I/O Cards	B-5
GS4-06CDD Combo I/O card	B-5
GS4-06NA Input card	B-7
GS4-06TR Output card	B-7
Optional Communications Cards	B-8
GS4-CM-xxxxxx Circuit Board Layout	B-8
Connecting Comm Card to PC	B-9
Communication Card Firmware Update Instructions	B-9
GS4-CM-MODTCP and GS4-CM-ENETIP IP Address and Network Configuration	B-13
GS4-CM-MODTCP Specifications	B-14
GS4-CM-MODTCP LED Indicators and Troubleshooting	B-15
GS4-CM-MODTCP Common Communication Parameters	B-16
GS4-CM-MODTCP Control Words	B-17
GS4-CM-MODTCP Status Words	B-18
GS4-CM-ENETIP Specifications	B-19
GS4-CM-ENETIP LED Indicators and Troubleshooting	B-20
GS4-CM-ENETIP Common Parameters	B-21
GS4-CM-ENETIP EtherNet/IP I/O Messaging (Implicit Messaging)	B-22
GS4-CM-ENETIP Explicit Messaging	B-26
EtherNet/IP Communication Card Register Settings	B-32
Using Speed Mode as a Control Method	B-32
APPENDIX C: ANALOG AND DIGITAL I/O PARAMETER MAPS	C-1
Introduction	C-2

GS4 Digital Inputs – Main Control Board	C-3
GS4 Digital Outputs – Main Control Board	C-4
GS4 Digital Inputs – Option Cards	C-5
GS4 Digital Outputs – Option Cards	C-6
GS4 Digital Outputs – Virtual.	C-7
GS4 Analog Common Parameters	C-8
GS4 Analog Input 1 Parameters	C-8
GS4 Analog Input 2 Parameters	C-9
GS4 Analog Input 3 Parameters	C-10
GS4 Analog Output 1 Parameters	C-11
GS4 Analog Output 2 Parameters	C-11
GS4 Frequency Output Parameters	C-11
APPENDIX D: USING GS4 AC DRIVES WITH AUTOMATIONDIRECT PLCs.	D-1
Appendix D Overview.	D-2
Sinking/Sourcing Basics.	D-2
GS4-to-PLC I/O Wiring Examples	D-4
Drive Wired with DC Sinking Inputs (PLC output card is sourcing)	D-4
Drive Wired with DC Sourcing Inputs (PLC output card is sinking)	D-4
Drive Wired with DC Sinking Outputs (PLC input card is sourcing)	D-5
Drive Wired with DC Sourcing Outputs (PLC input card is sinking)	D-5
Drive Relay Outputs Wired with Sinking PLC Modules	D-6
Drive Relay Outputs Wired with Sourcing PLC Modules	D-6
Drive Analog Inputs	D-7
Analog Input Wired for Voltage and Current	D-7
Drive Analog Outputs	D-8
Analog Output Wired for Voltage and Current	D-8
Drive Frequency Output (High-speed pulse output)	D-9
Communication with GS4 Drives.	D-10
Getting Started.	D-10
Serial Modbus Monitoring and Control	D-10
ModTCP (Ethernet) Monitor and Control	D-15
EtherNet/IP Monitor and Control	D-16
GS4-CM-ENETIP EtherNet/IP I/O Messaging (Implicit Messaging)	D-16
Program Examples Using AutomationDirect CLICK PLC	D-18
Modbus RTU CLICK Program Example.	D-18
Modbus TCP CLICK Program Example	D-22
APPENDIX E: SAFE TORQUE OFF	E-1
Safe Function Failure Rate	E-2
Safe Torque Off Terminal Function Description	E-2
Wiring Diagrams.	E-3
Internal STO Circuit	E-3
Control Loop Wiring Diagrams.	E-3
STO Parameters	E-4
Operating Sequence Description	E-5
STO P6.71=0.	E-5
STO P6.71=0, P6.29=1	E-5
STO P6.71=1.	E-5
STL1 P6.71=1, P6.29=0	E-6

STL2 P6.71=1, P6.29=1	E-6
Error Codes for STO Function	E-6
APPENDIX F: PID CONTROL	F-1
Function of PID Control.	F-2
What Does PID Control Accomplish?	F-2
PID Control Analogy.	F-2
Common Applications for PID Control	F-3
Definition of PID Loop "Directions"	F-3
Forward-Acting PID Loop (Heating Loop) (Negative-Feedback Loop)	F-3
Reverse-Acting PID Loop (Cooling Loop) (Positive-Feedback Loop)	F-3
PID Control Overview	F-4
Concept of GS4 PID Control & Tuning.	F-5
Proportional Gain (P)	F-5
Integral Time (I)	F-5
Derivative Value (D)	F-6
Proportional Integral Control (PI)	F-6
Proportional Derivative Control (PD).	F-6
Proportional Integral Derivative Control (PID).	F-6
Tuning Example for PID Control	F-7
DURAPULSE GS4 and GS3 PID Parameter Comparisons	F-9
GS4 Parameters Involved in PID Control – Summary.	F-10
GS4 Parameters Involved in PID Control – Details	F-11
GS4 Parameters Involved in PID Control – Details	F-11