

INDEX

A

- AC input power connections & specs 21
- AC power
 - jumpers 22
 - wiring options 23
- acceleration
 - acceleration feedforward control (SGAF) 83
- acceleration range 4
- accuracy
 - velocity 4
- actual position 77
- address
 - DIP switch selection 6
- air-flow space, minimum 11
- airborne contaminants 11
- airflow 14
- alignment mode 72, 123, 125
- analog ground 18, 19
- ANI input
 - feedback source 75
 - position 77
- APEX Series Motors
 - APEX602 Motor Specifications 101
 - APEX603 Motor Specifications 102
 - APEX604 Motor Specifications 103
 - APEX605 Motor Specifications 104
 - APEX606 Motor Specifications 105
 - APEX610 Motor Specifications 106
 - APEX620 Motor Specifications 107
 - APEX630 Motor Specifications 108
 - APEX635 Motor Specifications 109
 - APEX640 Motor Specifications 110
 - motor brake characteristics 97
 - repeatability 97
 - resolver accuracy 97
 - speed/torque curves 97
- APEX6151
 - connector locations 16
 - dimensions 12
 - internal connections 21
- APEX6152
 - connector locations 17
 - dimensions 13
 - internal connections 22
- APEX6154
 - connector locations 17
 - dimensions 13

- internal connections 22
- APEX615n
 - panel layout 14

B

- balance—offset adjustments 71
- baud rate 5
- BCD input via thumbwheels 34
- bias resistors
 - calculating 25
 - DIP switch selection 10
- brakes 44, 97
- brownout fault 62

C

- cables
 - I/O, extending 35
 - RS-232C 67
- calculating bias & termination resistors 25
- chattering servo response 78
- circuit drawings (*see back cover of manual, and "schematics, internal"*)
- closed-loop operation 75
- COM 2 port function 10
- command, servo output 75
- commanded position 77
- communication
 - Motion Architect 60
 - serial (*see serial communication*)
 - terminal emulation 49
 - troubleshooting 67
- commutation test mode 73, 123, 125
- CompuCAM™ 60
- conduit 3, 35
- configuration
 - bias resistor selection 10
 - COM 2 port function 10
 - DIP switches 125
 - motor current 6
 - RS-485 setup 10
 - serial communication on COM 2 10
 - termination resistor selection 10
- connections
 - computer 25, 49
 - daisy-chain 25
 - encoder 26
 - end-of-travel limit inputs 27
 - home limit inputs 27

- lengthening cables 35
- motor cable 47
- multi-drop 25
- PLC inputs 33
- PLC outputs 32
- power (VAC) input 21
- programmable inputs 32
- programmable outputs 33
- RP240 34
- RS-232C 25
- RS-485 25
- terminal 25, 49
- testing 48
- thumbwheels 34
- trigger inputs 28
- VM50 screw terminal adaptor 31
- connectors
 - drive auxiliary 36
 - encoder output 39
 - resolver 42
- contaminants 11
- continuous current 122, 124
- control signal 75
- controller output saturation 76
- cooling 14
- cooling the motor 58
- coupling the motor to the load 58
- critically damped servo response 78
- current foldback 63
- current foldback circuit 70
- current loop compensation 126, 128
- current settings 122, 124
- current, motor
 - selecting 6
- cycle power-definition 64

D

- daisy-chain connections 25
- damping 78
- DC common 95
- DC ground wire 94
- DDE6000™ 60
- debug tools 64
- defeating noise 96
- diagnostic LEDs 62
- dimensions
 - APEX6151 12
 - APEX6152 13
 - APEX6154 13
 - APEX615n 11

- motor 51
- DIP switch
 - function 125
 - location 6, 121, 123
- DIP switch locations 6
- DIP switch settings
 - bias & termination resistors 10
 - motor current 6
- DIP switches
 - APEX6151 7
 - APEX6152 8
 - APEX6154 9
- disassembling the APEX615n 10
- dissipation
 - heat 14
- disturbance 78
 - rejection of 81
- DRESET command 64
- drive
 - resetting 62, 64
- drive auxiliary connector 36
- drive specifications 4
- DRPCHK command 34

E

- earth ground 18, 19, 95
- electrical noise 3, 64
 - suppressing 35
- enable input 65
 - connections & specs 37
- enclosures
 - electrical 11
- encoder
 - connections 26
 - test 50
 - feedback source 75
 - position 77
 - quadrature outputs 40
 - specifications 26
 - Z channel 40
- encoder inputs 5
- encoder output connector 39
- end-of-travel limits
 - connections 27
- environmental specifications 4
- extending cables
 - I/O 35

F

- factory configuration 6
- fan 14
- fault conditions & fault recovery 64
- fault output
 - connections & specs 37
- fault relay 44
- fault relay terminals 44
- feedback data 75
- foldback, current 63, 70
 - LED 62
- front panel LEDs 62
- Fuses 4, 24

G

- gains
 - definition 75
 - tuning 84

- ground
 - ANA GND 18, 19
 - Chassis Ground 18, 19
 - connection diagram 19
 - floating 18
 - I/O GND 18, 19
 - Iso GND 18, 19
 - Motor Ground 18, 19
 - Motor Ground 20
 - mounting slot 18, 19
 - Shield 18, 19, 20
- ground connections 18
- ground loops 95
- grounding 3
 - mounting 12
 - procedure 18

H

- Hall effect
 - DIP switch select 127, 129
- hall effect input 39, 41
- hall effect mode
 - resolver jumpers 41
- hard limits (end-of-travel) (*see end-of-travel limits*)
- heat 4
- heat dissipation 14
- home inputs 5
- home limit input
 - connections & specs 27
- humidity 4, 11

I

- I/O cabling 35
- I/O GND 18, 19
- I2T limit 62, 63, 70
- inductance, motor 126, 128
- inductive load, connecting outputs to 33
- input power
 - frequency range 4
- input power
 - current 4
 - voltage range 4
- inputs
 - enable 65
 - encoder 5, 26
 - end-of-travel limits 27
 - general-purpose programmable 31
 - home 5
 - home limit 27
 - limits 5
 - power (AC) 21
 - programmable 5
 - problems 66
 - test 50
 - serial communication (*see serial communication*)
 - suppressing noise 35
 - trigger 28
 - triggers 5
- instability 78
- installation
 - connections (*see connections*)
 - DIP switch settings (*see DIP switch settings*)

- mounting (*see mounting*)
 - precautions 3
 - process overview 3
 - test 48
- integral feedback control (SGI) 81
- integral windup limit (SGILIM) 82
- internal fan 14
- Iso GND 18

J-K

- jumper settings 10
- jumpers
 - AC power connector 22
 - resolver connector 41

L

- latched-definition 64
- LEDs
 - front panel LEDs 62
- light emitting diodes (LEDs) 62
- limit input connections 27
- limits inputs 5
- load, coupling 58

M

- mechanical brake 45
- microelectronic components 96
- minimum air-flow space 11
- Motion Architect 60
- Motion Builder™ 60
- Motion Toolbox™ 60
- motion trajectory update 85
- motion trajectory update period 4
- motor
 - cooling 58
 - coupling 58
 - current selection 6
 - dimensions 51
 - modifying 51
 - mounting 51
- motor brakes 44, 97
- motor cables 47
- motor connections 47
- motor fault 62
- motor ground 18, 19, 20, 47
- motor inductance 122, 126
- motor specifications
 - APEX602 101
 - APEX603 102
 - APEX604 103
 - APEX605 104
 - APEX606 105
 - APEX610 106
 - APEX620 107
 - APEX630 108
 - APEX635 109
 - APEX640 110
- motor temperature 43
- motor temperature sensor input 43
- motor thermal time constant 126, 128
- mounting 12
 - APEX615n chassis 11
 - motor 51
- move completion criteria 91
- multi-drop
 - connections 25

internal configuration 10

N

National Electric Code Handbook i
negative-travel limits 27
noise
 defeating 96
 electrical 11
 externally conducted 94
 ground loops 95
 internal switching 94
 power line 93
 sensitivity 35
 transmitted 95
noise, electrical 3, 64
 suppression 93
 suppression on I/O cables 35

O

offset balance adjustments 71
open loop commutation 73
opening the APEX615n 10
oscillatory servo response 78, 82
output power
 frequency range 4
output power
 current 4
 voltage range 4
output saturation 76
outputs
 +5V 5
 general-purpose programmable 31
 OUT-A 31
 programmable 5
 problems 66
 test 50
over-damped servo response 78
overcurrent fault 62
overshoot 78, 82
overtemperature fault 62
overvoltage fault 62, 69

P

panel layout 14
peak current 7-9, 122, 126
performance specifications 4
pin outs
 encoder connector 26
 limits connector 27
 programmable inputs 31
 programmable outputs 31
PIV&F gains 80
PLC connections 32
polarity
 end-of-travel limit inputs 27
 home input 27
 programmable inputs 31
 programmable outputs 31
 trigger inputs 28
pole pair number 121, 124
PORT command 34
 COM 2 function 10
position
 actual (based on feedback device)
 77
 commanded 77

error 65, 77
 overshoot 82
 response (servo) 77
 types 78
 setpoint 77
 tracking error 77
position range 4
positive-travel limits 27
power
 wiring options 23
power connector
 jumpers 22
power line noise 93
power supply
 AC input connections & specs 21
 for limit inputs, & trigger inputs 28
 for P-CUT, limit inputs, & trigger
 inputs 27
 for programmable inputs & outputs
 31
power-up
 start-up program (startp)
 problems 66
pre-installation changes 6
precautions
 installation 3
 mounting 11
process of installation 3
product return procedure 73
programmable I/O
 connections & specs 31
programmable inputs 5
programming
 debug tools 64
 error messages 64
programming tools available 60
proportional feedback control (SGP) 80
pseudo-quadrature outputs 40

Q

quadrature outputs 40

R

regen fault 62, 68
regen resistor
 external 130-132
regeneration 48
removing the APEX615n frontplate 10
reset
 drive 64
RESET command 64
reset input 64
 connections & specs 36
resistor
 regeneration 48
resistor braking 46
resistors, termination/bias
 calculating 25
 selecting 10
resolver
 accuracy 97
 alignment 72
 resolution 4
 speed 125, 128
resolver connector 42
 fault relay terminals 43

response – servo 78
return procedure 73
rise time 78
RP240
 connections
 test 50
RP240, connections 34
RS-232C (*see serial communication*)
RS-232C communication 95
 disable handshaking 67
 troubleshooting 67
RS-485 (*see serial communication*)

S

safety 3
safety stops (*see end-of-travel limits*)
saturation of the control output 75
schematics, internal
 enable input 37
 encoder inputs 26
 fault output 37
 fault relay terminals.i.resolver
 connector
 fault relay terminals 44
 hall effect input 41
 limit inputs 27
 motor temperature sensor input 43
 programmable inputs and outputs
 31
 reset input 36
 resolver rotors & stators 42
 tachometer output 38
 trigger inputs 28
 ±15V output 38
serial communication
 RS-232C
 configuration 10
 connections 25
 daisy-chain connections 25
 specifications 5
 RS-485
 configuration 10
 connections 25
 multi-drop connections 25
 resistor calculation 25
 RP240 connections 34
 specifications 5
servo
 control methods/types 80
 sampling frequency 75, 85
 tuning, *see tuning*
servo sampling update period 4
setpoint 77
settling time 78
shield 20
shielding 3
 I/O cables 35
ship kit 2
short circuit fault 62
single speed resolver 125, 128
sinking input device, connecting to 33
sinking output device, connecting to
 28, 32
sourcing input device, connecting to
 33
sourcing output device, connecting to
 28, 32

- specifications
 - overall list of 4, 5
 - speed/torque curves 97
 - stability 78
 - status commands (*see also back cover, and test on page 20*)
 - axis (see TASF command)
 - limit switches (see TLIM command)
 - motor faults (see TASXF command)
 - programmable inputs (see TIN command)
 - programmable outputs (see TOUT command)
 - trigger inputs (see TIN command)
 - steady-state 79
 - position error 77
 - support software available 60
 - surge suppression 93, 96
 - switching voltage levels 5
 - Switching voltage levels for HOM, POS, NEG, TRG-A , TRG-B are based on V_I/O input voltage level 5
 - system update period 4
 - system update rate 85
- T**
- tachometer output
 - connections & specs 38
 - tachometer output calibration 72
 - tachometer scaling 123, 125
 - target zone 91
 - timeout error 91
 - temperature range 4, 11
 - temperature sensors 11
 - terminal emulation, set up 49
 - termination resistors
 - calculating 25
 - DIP switch selection 10
 - test
 - system installation 48
 - thermal time constant 122, 124
 - thumbwheel connections 34
 - timeout error 91
 - torque/speed curves 97
 - transient 79
 - transmitted noise 95
 - travel limits 27
 - trigger inputs
 - connections 28
 - triggers 5
 - troubleshooting 62
 - common problems & solutions 65
 - diagnostic LEDs 64
 - error messages 64
 - RS-232C 67
 - tuning 75
 - APEX615n tuning procedure 84
 - gains, definition 80
 - PIV&F algorithm 80
 - process flow diagram 86
 - related 6000 series commands 79
 - scenario (case example) 89
 - target zone mode 91
 - two-speed resolver 121, 124
- U**
- under-damped servo response 78
 - undervoltage fault 62
 - unstable 78
- V**
- V Bus+ and V Bus- 132
 - VBUS+ 48
 - velocity
 - velocity feedback control (SGV) 82
 - velocity feedforward control (SGVF) 83
 - velocity accuracy 4
 - velocity range 4
 - velocity repeatability 4
 - VM50 adaptor 31
 - V_I/O 27, 28
- W-Z**
- weight 5
 - windup of the integral action 82
 - wiring options
 - AC power 23
 - Z channel output 26
 - ±15V output
 - connections & specs 38