Guyton_Model

1 “environment” component

This component has no equations.

2 “temp_myogrs_and_pamk” component

This component has no equations.

3 “aldosterone” component

This component has no equations.

4 “angiotensin_control_of_aldosterone_secretion” component

AL1_to_AL3

$$ANMAL = ((ANM - 1) * ANMALD + 1)$$

5 “osmotic_control_of_aldosterone_secretion” component

AL4

$$OSMAL = \frac{(CKE - 3.3)}{1.0}$$

6 “aldosterone_secretion” component

AL5

$$AMRBSC = ANMAL * 0.909 * OSMAL$$

AL6_to_AL8

$$AMRT = ((AMRBSC - 1) * AMKMUL + 1)$$

AL9

$$AMR = \begin{cases} 0; & \text{if } AMRT < 0, \\ AMRT & \text{otherwise.} \end{cases}$$

AL9A_and_AL9B

$$AMR1 = \begin{cases} ALDKNS; & \text{if } ALDKNS > 0, \\ (AMR + ALDINF) & \text{otherwise.} \end{cases}$$

7 "aldosterone_concentration" component

AL10_to_AL12

$$\frac{\mathrm{d}(AMC)}{\mathrm{d}(time)} = \frac{(AMR1 - AMC)}{AMT}$$

8 "general_aldosterone_multiplier" component

AL13

$$AM1 = \left(AM1UL - \frac{(AM1UL - 1)}{\left(\frac{(AM1LL - 1)}{(AM1LL - AM1UL)} * (AMC - 1) * AMCSNS + 1 \right)} \right)$$

AL14_to_AL16

$$AM = ((AM1 - 1) * ALDMM + 1)$$

9 "aldosterone_effect_on_cell_membrane_K_transport" component

AL17_to_AL19

$$AMKT = ((AM - 1) * AMKM + 1)$$

AL20

$$AMK = \begin{cases} 0.2; & \text{if } AMKT < 0.2, \\ AMKT & \text{otherwise.} \end{cases}$$

10 "aldosterone_effect_on_cell_membrane_Na_transport" component

AL21_to_AL23

$$AMNAT = ((AM - 1) * AMNAM + 1)$$

AL24_and_AL25

$$AMNA = \begin{cases} AMNALL; & \text{if } AMNAT < AMNALL, \\ AMNAUL; & \text{if } AMNAT > AMNAUL, \\ AMNAT & \text{otherwise.} \end{cases}$$

11 "aldosterone_parameter_values" component

This component has no equations.

12 "angiotensin" component

This component has no equations.

13 "instantaneous_angiotensin_formation" component

AN1

$$MDFLW3 = MDFLW$$

AN2

$$ANGSCR = \begin{cases} \frac{1}{(1+(MDFLW3-1)*72)}; & \text{if } MDFLW3 > 1, \\ \left(10 - \frac{9}{(1+(1-MDFLW3)*8)}\right) & \text{otherwise.} \end{cases}$$

14 "time_delayed_angiotensin_formation" component

AN4_and_AN5

$$ANX = (ANGSCR - 1) * ANXM$$

AN6_to_AN8

$$\frac{\mathrm{d}(ANX1)}{\mathrm{d}(time)} = \frac{(ANX - ANX1)}{ANV}$$

15 "total_angiotensin_formation" component

AN9_and_AN10

$$ANPRT = (ANGSCR + ANX1) * REK$$

AN11

$$ANPR = \begin{cases} 0.00001; & \text{if } ANPRT < 0.00001, \\ ANPRT & \text{otherwise.} \end{cases}$$

16 "artificial_angiotensin_formation" component

AN11A_and_AN11B

$$ANPR1 = \begin{cases} ANGKNS; & \text{if } ANGKNS > 0, \\ (ANPR + ANGINF) & \text{otherwise.} \end{cases}$$

17 "angiotensin_concentration" component

AN12_to_AN14

$$\frac{\mathrm{d}(ANC)}{\mathrm{d}(time)} = \frac{(ANPR1 - ANC)}{ANT}$$

18 "general_angiotensin_multiplier" component

AN15

$$ANM = \left(ANMUL - \frac{(ANMUL - 1)}{\left(\frac{(ANMLL - 1)}{(ANMLL - ANMUL)} * (ANC - 1) * ANCSNS + 1 \right)} \right)$$

19 "angiotensin_effect_on_circulation" component

AN16_to_AN18

$$ANU1 = ((ANM - 1) * ANUM + 1)$$

AN19

$$ANU = \begin{cases} ANULL; & \text{if } ANU1 < ANULL, \\ ANU1 & \text{otherwise.} \end{cases}$$

20 "angiotensin_effect_on_venous_constriction" component

AN20_to_AN22

$$ANUVN = ((ANU - 1) * ANUVM + 1)$$

21 "angiotensin_parameter_values" component

This component has no equations.

22 “antidiuretic_hormone” component

This component has no equations.

23 “osmotic_control_of_ADH_secretion” component

AD1_to_AD3

$$ADHNA1 = \frac{(CNA - CNR)}{(142 - CNR)}$$

AD8

$$ADHNA = \begin{cases} 0; & \text{if } ADHNA1 < 0, \\ ADHNA1 & \text{otherwise.} \end{cases}$$

24 “pressure_control_of_ADH_secretion” component

AD4

$$ADHPA = \begin{cases} ADHPUL; & \text{if } PA1 > ADHPUL, \\ PA1 & \text{otherwise.} \end{cases}$$

AD5_to_AD7

$$ADHPR = ((ADHPUL - ADHPA))^2 * ADHPAM$$

25 “total_ADH_secretion” component

AD9

$$ADH1 = (ADHNA + ADHPR + ADHINF)$$

AD9_extended

$$ADH = \begin{cases} 0; & \text{if } ADH1 < 0, \\ ADH1 & \text{otherwise.} \end{cases}$$

26 “ADH_in_blood” component

AD10_to_AD13

$$\frac{\mathrm{d}(ADHC)}{\mathrm{d}(time)} = \frac{(ADH - ADHC)}{ADHTC}$$

27 “ADH_effect_on_nonrenal_vascular_resistance” component

AD14

$$ADHMV1 = \left(ADHVUL - \frac{(ADHVUL - 1)}{\left(\frac{(ADHVLL-1)}{(ADHVLL-ADHVUL)} * (ADHC - 1) + 1\right)}\right)$$

AD15

$$ADHMV = \begin{cases} ADHVLL; & \text{if } ADHMV1 < ADHVLL, \\ ADHMV1 & \text{otherwise.} \end{cases}$$

28 “ADH_effect_on_kidney” component

AD16

$$ADHMK1 = \left(ADHKUL - \frac{(ADHKUL - 1)}{\left(\frac{(ADHKLL-1)}{(ADHKLL-ADHKUL)} * (ADHC - 1) + 1\right)}\right)$$

AD17

$$ADHMK = \begin{cases} ADHKLL; & \text{if } ADHMK1 < ADHKLL, \\ ADHMK1 & \text{otherwise.} \end{cases}$$

29 “antidiuretic_hormone_parameter_values” component

This component has no equations.

30 “atrial_natriuretic_peptide” component

This component has no equations.

31 “total_ANP_secreted” component

ANP1_and_ANP1A

$$ANPL = \begin{cases} 0; & \text{if } (PLA - 1) * 1 < 0, \\ (PLA - 1) * 1 & \text{otherwise.} \end{cases}$$

ANP2_ANP3_and_ANP3A

$$ANPR2 = \begin{cases} 0; & \text{if } (PRA + 1) * 2 < 0, \\ (PRA + 1) * 2 & \text{otherwise.} \end{cases}$$

ANP4_and_ANP5

$$ANP = \frac{(ANPL + ANPR2)}{3}$$

32 “ANP_into_circulation” component

ANP7

$$ANP1 = \begin{cases} ANPKNS; & \text{if } ANPKNS > 0, \\ (ANP + ANPINF) & \text{otherwise.} \end{cases}$$

33 “ANP_in_plasma” component

ANP8_to_ANP10

$$\frac{\mathrm{d}(ANPC)}{\mathrm{d}(time)} = \frac{(ANP1 - ANPC)}{ANPTC}$$

34 “ANP_effect_on_renal_afferent_arteriolar_resistance” component

ANP11

$$ANPX1 = \left(ANPXUL - \frac{ANPXUL}{0.5555556 * (1 + ANPC)}\right)$$

ANP12

$$ANPX = \begin{cases} -(1); & \text{if } ANPX1 < -(1), \\ ANPX1 & \text{otherwise.} \end{cases}$$

35 “atrial_natriuretic_peptide_parameter_values” component

This component has no equations.

36 “autonomics” component

This component has no equations.

37 "pressure_driving_autonomic_receptors" component

AU1_and_AU2

$$PA1 = \begin{cases} CRRFLX; & \text{if } CRRFLX > 0.0000001, \\ (PA - EXE) & \text{otherwise.} \end{cases}$$

38 "chemoreceptors_effect_of_PA" component

AU4_and_AU19

$$AUC = \begin{cases} 0.005 * (80 - PA1) * AUC1; & \text{if } (PA1 < 80) \wedge (PA1 \geq 40), \\ 0.2 * AUC1; & \text{if } PA1 < 40, \\ 0 & \text{otherwise.} \end{cases}$$

39 "chemoreceptors_effect_of_art_PO2" component

AU20

$$AUC2 = \begin{cases} O2CHMO * (80 - PO2ART); & \text{if } (PO2ART < 80) \wedge (PO2ART \geq 40), \\ O2CHMO * 40; & \text{if } PO2ART < 40, \\ 0 & \text{otherwise.} \end{cases}$$

AU21

$$AUC3 = (AUC + AUC2)$$

40 "arterial_baroreceptor_reflex" component

AU3

$$AUB = \begin{cases} 0.016667 * (160 - PA1); & \text{if } (PA1 < 160) \wedge (PA1 \geq 80), \\ 1.3336; & \text{if } PA1 < 80, \\ 0 & \text{otherwise.} \end{cases}$$

AU6_AU7_and_part_AU8

$$A1B = ((AUB - 1) * AUX + 1)$$

rest_AU8

$$AU6A = (A1B - AU4)$$

AU9_to_AU11

$$\frac{\mathrm{d}(AU6)}{\mathrm{d}(time)} = \frac{(AU6A - AU6)}{BAROTC}$$

AU18

$$AU6C = AU6$$

41 "CNS_ischemic_reflex" component

AU5_and_AU22

$$AUN = \begin{cases} 0.04 * (40 - PA1) * AUN1; & \text{if } PA1 < 40, \\ 0 & \text{otherwise.} \end{cases}$$

42 "autonomic_response_to_vasculature_pressure" component

AU24_to_AU28

$$AULP = \left(\left(\frac{15}{(PLA + PRA + PPA)} - 1 \right) * AULPM + 1 \right)$$

43 "autonomic_response_to_exercise" component

AU29_to_AU32

$$AUEX = (EXC)^{EXCXP}$$

44 "total_autonomic_stimulation" component

AU23_and_AU33

$$AUTTL1 = ((AUEX * AULP * (AUC3 + AU6C + AUN) - 1) * EXCML + 1)$$

AU34

$$AUTTL = \begin{cases} 0; & \text{if } AUTTL1 < 0, \\ AUTTL1 & \text{otherwise.} \end{cases}$$

45 "actual_autonomic_stimulation" component

AU35

$$DAU = \frac{(AUTTL - AU1)}{AUDMP}$$

AU36_and_AU37

$$\frac{\mathrm{d}(AU1)}{\mathrm{d}(time)} = DAU$$

AU38

$$AUT = \left(AUMAX - \frac{(AUMAX - 1)}{e^{AUSLP*(AU1-1)}} \right)$$

AU39

$$AU = \begin{cases} AUMIN; & \text{if } AUT < AUMIN, \\ AUT & \text{otherwise.} \end{cases}$$

46 "autonomic_drive_on_target_organs_and_tissues" component

AU40_and_AU41

$$VVR = ((VV9 - AU * AUL) + AUL)$$

AU42

$$AUO = (AU - 1)$$

AU43_and_AU44

$$AUH = (AUO * AUV + 1)$$

AU45_and_AU46

$$AUR = (AUO * AUS + 1)$$

AU47_and_AU48

$$AOM = (AUO * O2A + 1)$$

AU50_to_AU52

$$AUM = ((AUO * AUM1 + 1))^{AUM2}$$

AU53_and_AU54

$$AVE = (AUO * AUY + 1)$$

47 "autonomics_parameter_values" component

This component has no equations.

48 "capillary_dynamics" component

This component has no equations.

49 "capillary_membrane_dynamics" component

This component has no equations.

50 "capillary_pressure" component

CP1_and_CP2

$$PC = (RVS * 1.7 * BFN + PVS)$$

51 "rate_of_fluid_out_of_capillaries" component

CP3_to_CP5

$$VTC = ((((PC - PPC) - PGH) + PTC) * CFC + VTCPL)$$

52 "plasma_volume_and_protein" component

This component has no equations.

53 "plasma_volume" component

CP10

$$VPD = (((VTL - VTC) - DFP) + TRPL)$$

CP11

$$\frac{\mathrm{d}(VP)}{\mathrm{d}(time)} = VPD$$

54 "plasma_protein_concentration" component

CP35

$$CPP = \frac{PRP}{VP}$$

55 "protein_destruction_and_formation" component

CP37_and_CP38

$$CPPD = \begin{cases} 0; & \text{if } (CPP - CPR) < 0, \\ (CPP - CPR) & \text{otherwise.} \end{cases}$$

CP39_to_CP41

$$DLP = \left(LPPR - (CPPD)^{LPDE} * LPK\right)$$

56 "plasma_leakage" component

CP25_and_CP26

$$PRCD = \begin{cases} 0; & \text{if } (PC - PCR) < 0, \\ (PC - PCR) & \text{otherwise.} \end{cases}$$

CP27_and_CP28

$$VTCPL = (PRCD * CPK)^{PCE}$$

57 "protein_influx_into_interstitium" component

CP29_to_CP32

$$DPC = (VTCPL * CPP + (CPP - CPI) * 0.00104)$$

58 "total_plasma_protein" component

CP33

$$DPP = ((((DLP + DPL) - DPC) - PPD) + TRPL * 72)$$

CP34

$$\frac{\mathrm{d}(PRP)}{\mathrm{d}(time)} = DPP$$

59 "plasma_colloid_osmotic_pressure" component

CP36

$$PPC = \left(0.28 * CPP + 0.0019 * (CPP)^2\right)$$

60 "systemic_tissue_fluid_volume_and_protein" component

This component has no equations.

61 "total_systemic_fluid_volume" component

CP6

$$VTS = ((VEC - VP) - VPF)$$

62 “interstitial_fluid_volume” component

CP7_to_CP7D

$$\frac{\mathrm{d}(VTS2)}{\mathrm{d}(time)} = ((VTS - 12) * TSSLML - VTS2) * TSSLTC$$

CP7E

$$VTS1 = (VTS - VTS2)$$

63 “total_interstitial_protein” component

CP42

$$DPI = (DPC - DPL)$$

CP43

$$\frac{\mathrm{d}(TSP)}{\mathrm{d}(time)} = DPI$$

64 “interstitial_protein_concentration” component

CP44

$$CPI = \frac{TSP}{VTS}$$

65 “interstitial_colloid_osmotic_pressure” component

CP45

$$PTCPR = \left(0.28 * CPI + 0.0019 * (CPI)^2\right)$$

66 “lymph_protein_flow” component

CP46

$$DPL = CPI * VTL$$

67 “tissue_gel_and_fluid_and_lymph_flow” component

This component has no equations.

68 "hydrostatic_pressure_of_tissue_gel" component

CP13_and_CP14

$$CHY = \left(\frac{\frac{HYL}{VTS}}{5}\right)^{CMPTSS}$$

CP15_and_CP16

$$PGH = (CHY * PGHF + PTT)$$

69 "total_osmotic_pressure_of_tissue_gel" component

CP17

$$POSHYL = CHY * 2$$

CP18

$$PTC = POSHYL * PTCPR * GCOPF$$

70 "total_tissue_pressure" component

CP12

$$PTT = \left(\frac{(VTS1 - VTSF)}{VTSF}\right)^2 * 1$$

71 "interstial_free_fluid_pressure" component

CP19

$$PIF = (PGH - POSHYL)$$

72 "interstitial_solid_tissue_pressure" component

CP20

$$PTS = (PTT - PIF)$$

73 "lymph_flow" component

CP21

$$PLD1 = ((PIF + PLDF) - PTT)$$

CP22

$$PLD = \begin{cases} 7; & \text{if } PLD1 > 7, \\ PLD1 & \text{otherwise.} \end{cases}$$

CP23_and_CP24

$$VTL = \begin{cases} 0; & \text{if } PLD < 0, \\ PLD * 0.02 & \text{otherwise.} \end{cases}$$

74 "interstitial_gel_volume" component

CP8

$$VG = \begin{cases} 0; & \text{if } VTS \leq 0, \\ \left(0 + \frac{(11.4-0)*(VTS-0)}{(12-0)}\right); & \text{if } (VTS > 0) \wedge (VTS \leq 12), \\ \left(11.4 + \frac{(14-11.4)*(VTS-12)}{(15-12)}\right); & \text{if } (VTS > 12) \wedge (VTS \leq 15), \\ \left(14 + \frac{(16-14)*(VTS-15)}{(18-15)}\right); & \text{if } (VTS > 15) \wedge (VTS \leq 18), \\ \left(16 + \frac{(17.3-16)*(VTS-18)}{(21-18)}\right); & \text{if } (VTS > 18) \wedge (VTS \leq 21), \\ \left(17.3 + \frac{(18-17.3)*(VTS-21)}{(24-21)}\right); & \text{if } (VTS > 21) \wedge (VTS \leq 24), \\ 18 & \text{otherwise.} \end{cases}$$

75 "interstitial_free_fluid_volume" component

CP9

$$VIF = (VTS - VG)$$

76 "capillary_dynamics_parameter_values" component

This component has no equations.

77 "circulatory_dynamics" component

This component has no equations.

78 "total_blood_volume_change" component

CD75

$$VBD = \frac{((((((VP + VRC) - VVS1) - VAS1) - VLA1) - VPA1) - VRA1)}{2}$$

79 "right_atrium" component

This component has no equations.

80 "right_atrial_blood_volume" component

CD20

$$DRA = (QVO - QRO)$$

CD21

$$\frac{\mathrm{d}(VRA1)}{\mathrm{d}(time)} = DRA$$

CD22_and_CD23

$$VRA = (VRA1 + VBD * 0.0574)$$

81 "right_atrial_pressure" component

CD24

$$VRE = (VRA - 0.1)$$

CD25

$$PRA = \frac{VRE}{0.005}$$

82 "autonomic_stimulation_effect_on_right_atrial_pressure" component

CD25C_to_CD25F

$$PRA1 = ((PRA + 8) * (HTAUML * (AU - 1) + 1) - 8)$$

83 "right_ventricle" component

This component has no equations.

84 "pressure_effect_on_right_ventricular_pumping" component

CD68

$$PP2 = \frac{\frac{PPA}{AUH}}{OSA}$$

CD69

$$RVM = \begin{cases} 1.06; & \text{if } PP2 \leq 0, \\ \left(1.06 + \frac{(0.97-1.06)*(PP2-0)}{(32-0)}\right); & \text{if } (PP2 > 0) \wedge (PP2 \leq 32), \\ \left(0.97 + \frac{(0.93-0.97)*(PP2-32)}{(38.4-32)}\right); & \text{if } (PP2 > 32) \wedge (PP2 \leq 38.4), \\ \left(0.93 + \frac{(0.8-0.93)*(PP2-38.4)}{(48-38.4)}\right); & \text{if } (PP2 > 38.4) \wedge (PP2 \leq 48), \\ \left(0.8 + \frac{(0.46-0.8)*(PP2-48)}{(60.8-48)}\right); & \text{if } (PP2 > 48) \wedge (PP2 \leq 60.8), \\ \left(0.46 + \frac{(0-0.46)*(PP2-60.8)}{(72-60.8)}\right); & \text{if } (PP2 > 60.8) \wedge (PP2 \leq 72), \\ 0 & \text{otherwise.} \end{cases}$$

85 "pumping_effectiveness_of_right_ventricle" component

CD70_to_CD74

$$HPEF = \left((1 - QRF) * AUH * RVM * HSR * HMD * HPR + \frac{QRF * QLO}{QLN}\right)$$

86 "right_ventricular_output" component

CD26

$$QRN = \begin{cases} 0; & \text{if } PRA1 \leq -(8), \\ \left(0 + \frac{(0.75-0)*(PRA1--(8))}{(-(6)--(8))}\right); & \text{if } (PRA1 > -(8)) \wedge (PRA1 \leq -(6)), \\ \left(0.75 + \frac{(2.6-0.75)*(PRA1--(6))}{(-(2)--(6))}\right); & \text{if } (PRA1 > -(6)) \wedge (PRA1 \leq -(2)), \\ \left(2.6 + \frac{(9.8-2.6)*(PRA1--(2))}{(4--(2))}\right); & \text{if } (PRA1 > -(2)) \wedge (PRA1 \leq 4), \\ \left(9.8 + \frac{(13.5-9.8)*(PRA1-4)}{(12-4)}\right); & \text{if } (PRA1 > 4) \wedge (PRA1 \leq 12), \\ 13.5 & \text{otherwise.} \end{cases}$$

CD27

$$QRO = QRN * HPEF$$

87 “pulmonary_vasculature” component

This component has no equations.

88 “pulmonary_vasculature_blood_volume” component

CD28

$$DPA = (QRO - QPO)$$

CD29

$$\frac{\mathrm{d}(VPA1)}{\mathrm{d}(time)} = DPA$$

CD30_and_CD31

$$VPA = (VPA1 + VBD * 0.155)$$

89 “pulmonary_vasculature_pressure” component

CD32

$$VPE = (VPA - 0.30625)$$

CD33

$$PPA = \frac{VPE}{0.0048}$$

90 “pulmonary_arterial_resistance” component

CD59

$$PP1T = 0.026 * PPA$$

CD60

$$PP1 = \begin{cases} 0.00001; & \text{if } PP1T < 0.00001, \\ PP1T & \text{otherwise.} \end{cases}$$

CD61

$$CPA = (PP1)^{0.5}$$

CD62

$$RPA = \frac{1}{CPA}$$

91 "pulmonary_venous_resistance" component

CD63

$$PL1 = (PLA + 18)$$

CD64

$$RPV = \frac{1}{PL1 * 0.0357}$$

92 "total_pulmonary_vascular_resistance" component

CD65

$$RPT = (RPV + RPA)$$

93 "pressure_gradient_through_the_lungs" component

CD34

$$PGL = (PPA - PLA)$$

94 "rate_of_blood_flow_from_pulmonary_veins_to_left_atrium" component

CD35

$$QPO = \frac{PGL}{RPT}$$

95 "left_atrium" component

This component has no equations.

96 "left_atrial_blood_volume" component

CD36

$$DLA = (QPO - QLO)$$

CD37

$$\frac{\mathrm{d}(VLA1)}{\mathrm{d}(time)} = DLA$$

CD38_and_CD39

$$VLA = (VLA1 + VBD * 0.128)$$

97 “left_atrial_pressure” component

CD40

$$VLE = (VLA - 0.38)$$

CD41

$$PLA = \frac{VLE}{0.01}$$

98 “autonomic_stimulation_effect_on_left_atrial_pressure” component

CD41A_to_CD41D

$$PLA1 = ((PLA + 4) * (HTAUML * (AU - 1) + 1) - 4)$$

99 “left_ventricle” component

This component has no equations.

100 “pumping_effectiveness_of_left_ventricle” component

CD66

$$PA2 = \frac{PA}{AUH * OSA}$$

CD67

$$LVM = \begin{cases} 1.04; & \text{if } PA2 \leq 0, \\ \left(1.04 + \frac{(1.025-1.04)*(PA2-0)}{(60-0)}\right); & \text{if } (PA2 > 0) \wedge (PA2 \leq 60), \\ \left(1.025 + \frac{(0.97-1.025)*(PA2-60)}{(125-60)}\right); & \text{if } (PA2 > 60) \wedge (PA2 \leq 125), \\ \left(0.97 + \frac{(0.88-0.97)*(PA2-125)}{(160-125)}\right); & \text{if } (PA2 > 125) \wedge (PA2 \leq 160), \\ \left(0.88 + \frac{(0.59-0.88)*(PA2-160)}{(200-160)}\right); & \text{if } (PA2 > 160) \wedge (PA2 \leq 200), \\ \left(0.59 + \frac{(0-0.59)*(PA2-200)}{(240-200)}\right); & \text{if } (PA2 > 200) \wedge (PA2 \leq 240), \\ 0 & \text{otherwise.} \end{cases}$$

101 “left_ventricular_output” component

CD42

$$QLN = \begin{cases} 0.01; & \text{if } PLA1 \leq -(2), \\ \left(0.01 + \frac{(3.6-0.01)*(PLA1--(2))}{(1--(2))}\right); & \text{if } (PLA1 > -(2)) \wedge (PLA1 \leq 1), \\ \left(3.6 + \frac{(9.4-3.6)*(PLA1-1)}{(5-1)}\right); & \text{if } (PLA1 > 1) \wedge (PLA1 \leq 5), \\ \left(9.4 + \frac{(11.6-9.4)*(PLA1-5)}{(8-5)}\right); & \text{if } (PLA1 > 5) \wedge (PLA1 \leq 8), \\ \left(11.6 + \frac{(13.5-11.6)*(PLA1-8)}{(12-8)}\right); & \text{if } (PLA1 > 8) \wedge (PLA1 \leq 12), \\ 13.5 & \text{otherwise.} \end{cases}$$

CD43

$$QLOT = LVM * QLN * AUH * HSL * HMD * HPL$$

CD43A_and_CD43B

$$QLO1 = \frac{(PLA - PA)}{3}$$

CD43C

$$QLO = \begin{cases} (QLOT + QLO1); & \text{if } QLO1 > 0, \\ QLOT & \text{otherwise.} \end{cases}$$

102 “systemic_venous_system” component

This component has no equations.

103 “venous_blood_volume” component

CD11

$$DVS = (QAO - QVO)$$

CD12

$$\frac{\mathrm{d}(VVS1)}{\mathrm{d}(time)} = DVS$$

CD13_and_CD14

$$VVS = (VVS1 + VBD * 0.3986)$$

104 “angiotensin_induced_venous_constriction” component

CD76_and_CD77

$$VVA = (ANU - 1) * ANY$$

105 "venous_excess_volume" component

CD15

$$VVE1 = (((((VVS - VVR) - VVA) - VV7) - VV6) - ATRVFB)$$

CD15_cont

$$VVE = \begin{cases} 0.0001; & \text{if } VVE1 < 0.0001, \\ VVE1 & \text{otherwise.} \end{cases}$$

106 "venous_average_pressure" component

CD16_to_CD16B

$$PVS1 = \left(3.7 + \frac{(VVE - 0.74)}{CV}\right)$$

CD16D

$$PVS = \begin{cases} 0.0001; & \text{if } PVS1 < 0.0001, \\ PVS1 & \text{otherwise.} \end{cases}$$

107 "venous_outflow_pressure_into_heart" component

CD25A_and_CD25B

$$PR1 = \begin{cases} PR1LL; & \text{if } PRA < PR1LL, \\ PRA & \text{otherwise.} \end{cases}$$

108 "resistance_from_veins_to_right_atrium" component

CD18_to_CD18B

$$RVG = \frac{0.74}{\left(\frac{PVS}{VIM*3.7}\right)^{0.5}}$$

109 "rate_of_blood_flow_from_veins_to_right_atrium" component

CD17

$$PGV = (PVS - PR1)$$

CD19

$$QVO = \frac{PGV}{RVG}$$

110 “venous_resistance” component

CD50_to_CD53

$$CN3 = ((PC - 17) * CN7 + 17) * CN2$$

CD55

$$RV1 = \frac{RVSM}{CN3}$$

CD56

$$RVS = AVE * RV1 * VIM * ANUVN$$

111 “NM_NR_venous_resistance” component

CD57

$$NNRVR = RVS * 1.79$$

112 “systemic_arterial_system” component

This component has no equations.

113 “arterial_blood_volume” component

CD1

$$DAS = (QLO - QAO)$$

CD2

$$\frac{\mathrm{d}(VAS1)}{\mathrm{d}(time)} = DAS$$

CD3_and_CD4

$$VAS = (VAS1 + VBD * 0.261)$$

114 “arterial_pressure_and_pressure_gradient” component

CD5

$$VAE = (VAS - 0.495)$$

CD6

$$PA = \frac{VAE}{0.00355}$$

CD78

$$PAG = (PA - PRA)$$

115 “pressure_effect_on_arterial_distention” component

CD44_and_CD45

$$PAM = \left(\frac{PA}{100}\right)^{PAEX}$$

116 “non_renal_systemic_arterial_resistance_multiplier” component

CD46_and_CD47

$$R1 = \frac{\frac{ANU*ADHMV*AUM*VIM*PAMK}{PAM}}{ATRRFB}$$

117 “NM_NR_arterial_resistance” component

CD49

$$NNRAR = RAR*ARM*R1*MYOGRS*RMULT1$$

118 “pressure_gradient_from_arteries_to_veins” component

CD7

$$PGS = (PA - PVS)$$

119 “M_systemic_resistance” component

CD48

$$RSM = RAM*AMM*R1*MYOGRS*RMULT1$$

120 “total_NM_NR_systemic_resistance” component

CD58

$$RSN = (NNRAR + NNRVR)$$

121 “blood_flow_through_M_tissues” component

CD9

$$BFM = \frac{PGS}{RSM}$$

122 "blood_flow_through_NM_NR_tissues" component

CD8

$$BFN = \frac{PGS}{RSN}$$

123 "blood_flow_through_AV_fistulas" component

CD79

$$FISFLO = PAG * FIS$$

124 "systemic_blood_flow" component

CD10

$$SYSFLO = (BFM + BFN + RBF)$$

CD10_cont

$$QAO = (SYSFLO + FISFLO)$$

125 "total_peripheral_resistance" component

CD80

$$RTP = \frac{PAG}{QAO}$$

126 "circulatory_dynamics_parameter_values" component

This component has no equations.

127 "electrolytes" component

This component has no equations.

128 "extracellular_Na_concentration" component

EL1_to_EL3

$$NED = ((NID * STH - NOD) + TRPL * 142)$$

EL4

$$\frac{\mathrm{d}(NAE)}{\mathrm{d}(time)} = NED$$

EL5

$$CNA = \frac{NAE}{VEC}$$

129 "aldosterone_effect_on_cellular_K_distribution" component

EL9_to_EL11

$$AMK1 = ((AMK - 1) * ALCLK + 1)$$

130 "extracellular_K_concentration" component

EL6

$$KTOTD = (KID - KOD)$$

EL7

$$\frac{\mathrm{d}(KTOT)}{\mathrm{d}(time)} = KTOTD$$

EL7A_and_EL7B

$$KE = \frac{(KTOT - 3000)}{AMK1 * 9.3333}$$

EL8

$$CKE = \frac{KE}{VEC}$$

131 "intracellular_K_concentration" component

EL12

$$KI = (KTOT - KE)$$

EL13

$$CKI = \frac{KI}{VIC}$$

132 "intracellular_fluid_volume" component

EL14

$$CCD = (CKI - CNA)$$

EL15

$$VID = CCD * VIDML$$

EL16

$$\frac{\mathrm{d}(VIC)}{\mathrm{d}(time)} = VID$$

133 “total_body_water” component

EL17_and_EL18

$$\frac{\mathrm{d}(VTW)}{\mathrm{d}(time)} = (TVD - VUD)$$

134 “extracellular_fluid_volume” component

EL19

$$VEC = (VTW - VIC)$$

135 “electrolytes_parameter_values” component

This component has no equations.

136 “heart_hypertrophy_or_deterioration” component

This component has no equations.

137 “left_ventricular_hypertrophy” component

HH1_to_HH5

$$\frac{\mathrm{d}(HPL)}{\mathrm{d}(time)} = \frac{\left(\left(\frac{PA*QAO}{500*HSL}\right)^{Z13} - HPL\right)}{57600}$$

138 “right_ventricular_hypertrophy” component

HH6_to_HH10

$$\frac{\mathrm{d}(HPR)}{\mathrm{d}(time)} = \frac{\left(\left(\frac{PPA*QAO}{75*HSR}\right)^{Z13} - HPR\right)}{57600}$$

139 “heart_deterioration” component

HH11_and_HH12

$$DHM = (POT - 10) * DHDTR$$

HH13

$$\frac{\mathrm{d}(HMD1)}{\mathrm{d}(time)} = DHM$$

HH14

$$HMD = \begin{cases} 1; & \text{if } HMD1 > 1, \\ HMD1 & \text{otherwise.} \end{cases}$$

140 "heart_hypertrophy_or_deterioration_parameter_values" component

This component has no equations.

141 "heart_rate_and_stroke_volume" component

This component has no equations.

142 "effect_of_autonomic_stimulation_on_HR" component

HR1

$$AUHR = 72 * AUR$$

143 "effect_of_PRA_on_HR" component

HR1A_and_HR2

$$PRHR = (PR1LL)^{0.5} * 5$$

144 "effect_of_heart_deterioration_on_HR" component

HR4_to_HR6

$$HDHR = ((HMD - 1) * 0.5 + 1)$$

145 "heart_rate" component

HR3_and_HR7

$$HR = (AUHR + PRHR) * HDHR$$

146 "stroke_volume_output" component

HR8

$$SVO = \frac{QLO}{HR}$$

147 "HR_and_SV_parameter_values" component

This component has no equations.

148 "muscle_autoregulatory_local_blood_flow_control" component

This component has no equations.

149 "M_autoregulatory_driving_force" component

ARM1

$$PDO = (PMO - 38)$$

150 "M_short_term_autoregulation" component

This component has no equations.

151 "M_ST_sensitivity_control" component

ARM2_and_ARM3

$$POE = (PDO * POM + 1)$$

152 "M_ST_time_delay_and_limit" component

ARM5_to_ARM7

$$\frac{\mathrm{d}(AMM1T)}{\mathrm{d}(time)} = \frac{(POE * 1 - AMM1T)}{A4K}$$

ARM7A

$$AMM1 = \begin{cases} AMM4; & \text{if } AMM1T < AMM4, \\ AMM1T & \text{otherwise.} \end{cases}$$

153 "M_long_term_autoregulation" component

This component has no equations.

154 "M_LT_sensitivity_control" component

ARM8_and_part_ARM9

$$POF = (POM2 * PDO + 1)$$

155 "M_LT_time_delay" component

ARM9_cont_to_ARM11

$$\frac{\mathrm{d}(AMM2)}{\mathrm{d}(time)} = \frac{(POF * 1 - AMM2)}{A4K2}$$

156 "global_M_blood_flow_autoregulation_output" component

ARM12

$$AMM = AMM1 * AMM2$$

157 "M_autoregulatory_local_blood_flow_parameter_values" component

This component has no equations.

158 "muscle_O2_delivery" component

This component has no equations.

159 "M_O2_blood_supply" component

OM1

$$O2ARTM = OVA * BFM$$

160 "M_venous_O2_content" component

OM2_to_OM4

$$OVS = \frac{(O2ARTM - RMO)}{HM * 5.25 * BFM}$$

OM5_and_OM5A

$$PVO = 57.14 * OVS * (EXC)^{EXCXP2}$$

161 "metabolic_O2_consumption_by_M_tissue" component

OM17_and_OM18

$$P2O = \begin{cases} 38; & \text{if } PMO > 38, \\ PMO & \text{otherwise.} \end{cases}$$

OM19_to_OM23

$$MMO = AOM * OMM * EXC * \left(1 - \frac{((38.0001 - P2O))^3}{54872}\right)$$

162 "delivery_of_O2_to_M_tissues" component

OM6_and_OM8

$$RMO = (PVO - PMO) * PM5 * BFM$$

163 "volume_of_O2_in_M_tissue" component

OM9

$$DO2M = (RMO - MMO)$$

OM10

$$\frac{\mathrm{d}(QOM1)}{\mathrm{d}(time)} = DO2M$$

OM11

$$QOM = \begin{cases} 0.0001; & \text{if } QOM1 < 0.0001, \\ QOM1 & \text{otherwise.} \end{cases}$$

164 "pressure_of_O2_in_M_tissue_cells" component

OM12

$$PMO = PK2 * QOM$$

165 “M_O2_delivery_parameter_values” component

This component has no equations.

166 “non_muscle_autoregulatory_local_blood_flow_control” component

This component has no equations.

167 “NM_autoregulatory_driving_force” component

ARN1

$$POD = (POT - POR)$$

168 “NM_short_term_autoregulation” component

This component has no equations.

169 “NM_ST_sensitivity_control” component

ARN2_and_ARN3

$$POB = (POD * POK + 1)$$

170 “NM_ST_time_delay_and_damping” component

ARN5_to_ARN7

$$\frac{\mathrm{d}(AR1T)}{\mathrm{d}(time)} = \frac{(POB * 1 - AR1T)}{A1K}$$

ARN7A

$$AR1 = \begin{cases} 0.5; & \text{if } AR1T < 0.5, \\ AR1T & \text{otherwise.} \end{cases}$$

171 “NM_intermediate_autoregulation” component

This component has no equations.

172 "NM_I_sensitivity_control" component

ARN8_and_ARN9

$$POA = (PON * POD + 1)$$

173 "NM_I_time_delay_and_limit" component

ARN11_to_ARN13

$$\frac{\mathrm{d}(AR2T)}{\mathrm{d}(time)} = \frac{(POA * 1 - AR2T)}{A2K}$$

ARN13A

$$AR2 = \begin{cases} 0.5; & \text{if } AR2T < 0.5, \\ AR2T & \text{otherwise.} \end{cases}$$

174 "NM_long_term_autoregulation" component

This component has no equations.

175 "NM_LT_sensitivity_control" component

ARN14

$$POC = (POZ * POD + 1)$$

176 "NM_LT_time_delay_and_limit" component

ARN15_to_ARN17

$$\frac{\mathrm{d}(AR3T)}{\mathrm{d}(time)} = \frac{(POC * 1 - AR3T)}{A3K}$$

ARN17A

$$AR3 = \begin{cases} 0.3; & \text{if } AR3T < 0.3, \\ AR3T & \text{otherwise.} \end{cases}$$

177 "total_NM_autoregulation" component

ARN18

$$ARM1 = AR1 * AR2 * AR3$$

178 “global_NM_blood_flow_autoregulation_output” component

ARN19_to_ARN21

$$ARM = ((ARM1 - 1) * AUTOSN + 1)$$

179 “NM_autoregulatory_local_blood_flow_parameter_values” component

This component has no equations.

180 “non_muscle_O2_delivery” component

This component has no equations.

181 “NM_O2_blood_supply” component

ONM1

$$O2ARTN = OVA * BFN$$

182 “NM_venous_O2_content” component

ONM2_to_ONM4

$$OSV = \frac{(O2ARTN - DOB)}{HM * 5.25 * BFN}$$

ONM5

$$POV = OSV * 57.14$$

183 “O2_consumption_by_NM_tissue” component

ONM14_and_ONM15

$$P1O = \begin{cases} 35; & \text{if } POT > 35, \\ POT & \text{otherwise.} \end{cases}$$

ONM16_to_ONM20

$$MO2 = AOM * O2M * \left(1 - \frac{((35.0001 - P1O))^3}{42875}\right)$$

184 “delivery_of_O2_to_NM_tissues” component

ONM6_and_ONM7

$$DOB = (POV - POT) * 12.857 * BFN$$

185 “volume_of_O2_in_NM_tissue” component

ONM8

$$DO2N1 = (DOB - MO2)$$

ONM9

$$DO2N = \begin{cases} DO2N1 * 0.1; & \text{if } (QO2 < 6) \wedge (DO2N1 < 0), \\ DO2N1 & \text{otherwise.} \end{cases}$$

ONM10

$$\frac{\mathrm{d}(QO2T)}{\mathrm{d}(time)} = DO2N$$

ONM10_cont

$$QO2 = \begin{cases} 0; & \text{if } QO2T < 0, \\ QO2T & \text{otherwise.} \end{cases}$$

186 “pressure_of_O2_in_NM_tissue_cells” component

ONM11

$$POT = QO2 * 0.48611$$

187 “NM_O2_delivery_parameter_values” component

This component has no equations.

188 “pulmonary_fluid_dynamics” component

This component has no equations.

189 “pulmonary_capillary_pressure” component

PD1_to_PD3

$$PCP = \left(\frac{(PPA - PLA) * RPV}{(RPV + RPA)} + PLA \right)$$

190 "fluid_filtration_into_pulmonary_interstitium" component

PD4_and_PD5

$$PFI = (((PCP - PPI) + POS) - PPC) * CPF$$

191 "pulmonary_interstitial_free_fluid_volume" component

PD5A

$$DFZ = (PFI - PLF)$$

PD5B

$$DFP = DFZ$$

PD6

$$\frac{\mathrm{d}(VPF1)}{\mathrm{d}(time)} = DFP$$

PD5C

$$VPF = \begin{cases} 0.001; & \text{if } VPF1 < 0.001, \\ VPF1 & \text{otherwise.} \end{cases}$$

192 "pulmonary_interstitial_fluid_pressure" component

PD10_and_PD11

$$PPI = \left(2 - \frac{0.15}{VPF}\right)$$

193 "concentration_of_protein_in_pulmonary_interstitium" component

PD15

$$PPZ = (PPN - PPO)$$

PD15A

$$PPD = PPZ$$

PD16

$$\frac{\mathrm{d}(PPR1)}{\mathrm{d}(time)} = PPD$$

PD15B

$$PPR = \begin{cases} 0.025; & \text{if } PPR1 < 0.025, \\ PPR1 & \text{otherwise.} \end{cases}$$

PD17

$$CPN = \frac{PPR}{VPF}$$

194 "colloid_osmotic_pressure_of_pulmonary_interstitium" component

PD18

$$POS = CPN * 0.4$$

195 "protein_leakage_into_pulmonary_interstitium" component

PD19_and_PD20

$$PPN = (CPP - CPN) * 0.000225$$

196 "lung_lymphatic_protein_flow" component

PD12_and_PD13

$$PLF = (PPI + 11) * 0.0003$$

PD14

$$PPO = PLF * CPN$$

197 "pulmonary_fluid_dynamics_parameter_values" component

This component has no equations.

198 "pulmonary_O2_uptake" component

This component has no equations.

199 "total_O2_utilization" component

PO1

$$O2UTIL = (DOB + RMO)$$

200 “alveolar_ventilation” component

PO2

$$ALVENT = O2UTIL * VNTSTM * 0.026667 * O2VTS2 * O2VAD2$$

201 “alveolar_PO2” component

PO3_and_PO4

$$PO2ALV = \left(PO2AMB - \frac{\frac{O2UTIL}{ALVENT}}{0.761} \right)$$

202 “respiratory_O2_diffusion_into_capillaries” component

PO6_and_PO7

$$RSPDFC = \frac{PL2}{(VPTISS + VPF)}$$

PO5_and_PO8

$$O2DFS = (PO2ALV - PO2ART) * RSPDFC$$

203 “O2_volume_of_arterial_blood” component

PO9_and_PO10

$$DOVA = \frac{(O2DFS - O2UTIL)}{QRO * 1.0}$$

PO11

$$\frac{\mathrm{d}(OVA)}{\mathrm{d}(time)} = DOVA$$

204 “arterial_PO2” component

PO12

$$OSA = \frac{\frac{OVA}{HM}}{5.25}$$

PO13

$$PO2ART = \begin{cases} (114 + (OSA - 1) * 6667)\,; & \text{if } OSA > 1, \\ (74 + (OSA - 0.936) * 625)\,; & \text{if } (OSA > 0.936) \wedge (OSA \leq 1), \\ (46 + (OSA - 0.8) * 205.882)\,; & \text{if } (OSA > 0.8) \wedge (OSA \leq 0.936), \\ OSA * 57.5 & \text{otherwise.} \end{cases}$$

205 “chemoreceptor_adaptation_of_alveolar_ventilation” component

This component has no equations.

206 “acute_chemoreceptor_adaptation_of_alveolar_ventilation” component

PO14_and_PO15

$$O2VTST1 = \frac{(PO2ART - 67)}{30}$$

PO16_and_PO17

$$O2VTST = \begin{cases} 1; & \text{if } O2VTST1 > 1, \\ 0.6; & \text{if } O2VTST1 < 0.6, \\ O2VTST1 & \text{otherwise.} \end{cases}$$

PO18

$$O2VTS2 = \frac{1}{O2VTST}$$

207 “progressive_chemoreceptor_adaptation_of_alveolar_ventilation” component

PO19_to_PO22

$$DO2VAD = ((O2VTS2 - 1) * 3 - O2VAD1) * 0.0005$$

PO23

$$\frac{\mathrm{d}(O2VAD1)}{\mathrm{d}(time)} = DO2VAD$$

PO24

$$O2VAD2 = (O2VAD1 + 1)$$

208 “pulmonary_O2_uptake_parameter_values” component

This component has no equations.

209 “red_cells_and_viscosity” component

This component has no equations.

210 “blood_viscosity_calculations” component

This component has no equations.

211 “hematocrit_fraction” component

RC6

$$VB = (VP + VRC)$$

RC7

$$HM1 = \frac{VRC}{VB}$$

RC8

$$HM = 100 * HM1$$

212 “viscosity_due_to_RBCs” component

RC9_to_RC11

$$VIE = \frac{HM}{(HMK - HM) * HKM}$$

213 “blood_viscosity” component

RC12

$$VIB = (VIE + 1.5)$$

RC13

$$VIM = 0.3333 * VIB$$

214 “RBC_formation_and_destruction” component

This component has no equations.

215 “oxygen_stimulation” component

RC1D

$$PO2AM1 = \begin{cases} 80; & \text{if } PO2AMB > 80, \\ PO2AMB & \text{otherwise.} \end{cases}$$

RC1A_and_RC1B

$$HM3 = (PO2AM1 - 40) * HM$$

RC1

$$HM4 = (PO2AMB - 40)$$

RC1C_and_RC2C

$$HM5 = \begin{cases} 0; & \text{if } (HM3 + HM4) < 0, \\ (HM3 + HM4) & \text{otherwise.} \end{cases}$$

RC2

$$HM7 = (HM6 - HM5)$$

216 "RBC_production" component

RC2A_RC2B_and_RC2E

$$RC1 = \begin{cases} 0; & \text{if } (HM7 * HM8 * REK + 0.000005) < 0, \\ (HM7 * HM8 * REK + 0.000005) & \text{otherwise.} \end{cases}$$

217 "RBC_destruction" component

RC5

$$RC2 = VRC * RKC * VIM$$

218 "RBC_volume" component

RC3

$$RCD = ((RC1 - RC2) + TRRBC)$$

RC4

$$\frac{\mathrm{d}(VRC)}{\mathrm{d}(time)} = RCD$$

219 "red_cells_and_viscosity_parameter_values" component

This component has no equations.

220 "stress_relaxation" component

This component has no equations.

221 "short_term_stress_relaxation" component

SR1_to_SR5

$$\frac{\mathrm{d}(VV7)}{\mathrm{d}(time)} = \frac{((VVE - 0.74) * SR - VV7)}{SRK}$$

222 "long_term_stress_relaxation" component

SR1A_to_SR5A

$$\frac{\mathrm{d}(VV6)}{\mathrm{d}(time)} = \frac{((VVE - 0.74) * SR2 - VV6)}{SRK2}$$

223 "stress_relaxation_parameter_values" component

This component has no equations.

224 "thirst_drinking_and_salt_appetite" component

This component has no equations.

225 "effect_of_salt_appetite_stimulation_on_thirst" component

TS2_TS2A_and_TS2B

$$ANMSML = ((ANM - 1) * ANMSLT + 1)$$

TS1_TS1A_and_TS2C

$$STH1 = ((Z10 - POT))^2 * Z11 * ANMSML$$

TS3_and_TS4

$$STH = \begin{cases} 0.8; & \text{if } STH1 < 0.8, \\ 8; & \text{if } STH1 > 8, \\ STH1 & \text{otherwise.} \end{cases}$$

226 "effect_of_antidiuretic_hormone_on_thirst" component

TS5_to_TS7

$$AHCM = ((ADHC - 1) * AHTHM + 1)$$

227 "effect_of_angiotensin_on_thirst" component

TS10_and_TS11

$$ANMTH = (ANM - 1) * ANMTM * 0.001$$

228 "rate_of_fluid_intake" component

TS8

$$AHTH1 = AHCM * STH * 0.001$$

TS9

$$AHTH = \begin{cases} 0; & \text{if } AHTH1 < 0, \\ AHTH1 & \text{otherwise.} \end{cases}$$

TS12

$$TVZ1 = (ANMTH + AHTH) * 1$$

TS13

$$TVZ = \begin{cases} 0; & \text{if } TVZ1 < 0, \\ TVZ1 & \text{otherwise.} \end{cases}$$

TS14_to_TS16

$$\frac{\mathrm{d}(TVD)}{\mathrm{d}(time)} = \frac{((TVZ + DR) - TVD)}{TVDDL}$$

229 "thirst_drinking_and_salt_appetite_parameter_values" component

This component has no equations.

230 "volume_receptors" component

This component has no equations.

231 "effect_of_pressure_on_volume_receptors" component

VR1_and_VR2

$$AHZ1 = (|)^{AH10} * AH9$$

VR1_cont

$$AHZ = \begin{cases} -(AHZ1); & \text{if } PRA < 0, \\ AHZ1 & \text{otherwise.} \end{cases}$$

232 "time_dependent_volume_receptor_adaptation" component

VR3_to_VR5

$$\frac{\mathrm{d}(AHY)}{\mathrm{d}(time)} = \frac{(AHZ - AHY)}{AH11}$$

233 "total_volume_nervous_feedback" component

VR6

$$AH7 = (AHZ - AHY)$$

234 "volume_effect_on_arteries" component

VR7_and_VR8

$$ATRRFB = (AH7 * ATRFBM + 1)$$

235 "volume_effect_on_unstressed_venous_volume" component

VR9

$$ATRVFB = AH7 * ATRVM$$

236 "volume_receptors_parameter_values" component

This component has no equations.

237 "kidney" component

This component has no equations.

238 "perfusion_pressure" component

KD2A

$$\frac{\mathrm{d}(PAR1)}{\mathrm{d}(time)} = \frac{((100 + (PA - 100) * RCDFPC) - PAR1)}{RCDFDP}$$

KD1_KD2_and_KD2A

$$PAR = \begin{cases} RAPRSP; & \text{if } (RAPRSP > 0) \wedge (RFCDFT \leq 0), \\ PAR1; & \text{if } RFCDFT > 0, \\ (PA - GBL) & \text{otherwise.} \end{cases}$$

239 “renal_autoregulatory_feedback_factor” component

KD57_to_KD61

$$RNAUG1T = ((MDFLW - 1) * RNAUGN + 1)$$

KD62_and_KD63

$$RNAUG1 = \begin{cases} RNAULL; & \text{if } RNAUG1T < RNAULL, \\ RNAUUL; & \text{if } RNAUG1T > RNAUUL, \\ RNAUG1T & \text{otherwise.} \end{cases}$$

KD64

$$RNAUG2 = (RNAUG1 - RNAUG3)$$

KD65_to_KD67

$$\frac{\mathrm{d}(RNAUG3)}{\mathrm{d}(time)} = (RNAUG2 - 1) * RNAUAD$$

240 “afferent_arterial_resistance” component

This component has no equations.

241 “autonomic_effect_on_AAR” component

KD10_to_KD12

$$AUMKT = ((AUM - 1) * ARF + 1)$$

KD13

$$AUMK = \begin{cases} 0.8; & \text{if } AUMKT < 0.8, \\ AUMKT & \text{otherwise.} \end{cases}$$

242 “angiotensin_effect_on_AAR” component

KD3_KD7_and_KD8

$$ANMAR1 = ((ANM - 1) * ANMAM + 1)$$

KD8A

$$ANMAR = \begin{cases} ANMARL; & \text{if } ANMAR1 < ANMARL, \\ ANMAR1 & \text{otherwise.} \end{cases}$$

243 “AAR_calculation” component

KD9

$$AAR1 = AARK * PAMKRN * AUMK * RNAUG2 * ANMAR * 40 * MYOGRS$$

244 “atrial_natriuretic_peptide_effect_on_AAR” component

KD21_and_KD22

$$AART = ((AAR1 - ANPX * ANPXAF) + ANPXAF)$$

KD23

$$AAR = \begin{cases} AARLL; & \text{if } AART < AARLL, \\ AART & \text{otherwise.} \end{cases}$$

245 “efferent_arterial_resistance” component

This component has no equations.

246 “autonomic_effect_on_EAR” component

KD14_to_KD16

$$AUMK2 = ((AUMK - 1) * AUMK1 + 1)$$

247 “angiotensin_effect_on_EAR” component

KD3_to_KD5

$$ANMER = ((ANM - 1) * ANMEM + 1)$$

248 “effect_of_renal_autoregulatory_feedback_on_EAR” component

KD17_to_KD19

$$RNAUG4 = ((RNAUG2 - 1) * EFAFR + 1)$$

249 “EAR_calculation” component

KD6

$$EAR1 = 43.333 * EARK * ANMER * RNAUG4 * MYOGRS * AUMK2$$

KD6A

$$EAR = \begin{cases} EARLL; & \text{if } EAR1 < EARLL, \\ EAR1 & \text{otherwise.} \end{cases}$$

250 “total_renal_resistance” component

KD20

$$RR = (AAR + EAR)$$

251 “normal_renal_blood_flow” component

KD24A

$$RFN = \frac{PAR}{RR}$$

252 “actual_renal_blood_flow” component

KD73

$$RBF = REK * RFN$$

253 “glomerular_capillaries” component

This component has no equations.

254 “glomerular_colloid_osmotic_pressure” component

KD68_to_KD71

$$EFAFPR1 = \frac{RFN * (1 - HM1)}{(RFN * (1 - HM1) - GFN)}$$

KD71A

$$EFAFPR = \begin{cases} 1; & \text{if } EFAFPR1 < 1, \\ EFAFPR1 & \text{otherwise.} \end{cases}$$

KD72_to_KD72B

$$GLPC = \begin{cases} (EFAFPR)^{1.35} * PPC * 0.98; & \text{if } GLPCA > 0, \\ (PPC + 4) & \text{otherwise.} \end{cases}$$

255 "glomerular_pressure" component

KD24

$$APD = AAR * RFN$$

KD25

$$GLP = (PAR - APD)$$

256 "glomerular_filtration_rate" component

KD26

$$PFL = ((GLP - GLPC) - PXTP)$$

KD27

$$GFN1 = PFL * GFLC$$

KD28

$$GFN = \begin{cases} GFNLL; & \text{if } GFN1 < GFNLL, \\ GFN1 & \text{otherwise.} \end{cases}$$

KD51

$$GFR = GFN * REK$$

257 "proximal_tubular_and_macula_densa_flow" component

KD29

$$PTFL = GFN * 8$$

KD30_to_KD32

$$MDFLWT = ((PTFL - 1) * MDFL1 + 1)$$

KD33

$$MDFLW = \begin{cases} 0; & \text{if } MDFLWT < 0, \\ MDFLWT & \text{otherwise.} \end{cases}$$

258 "renal_tissue_osmotic_pressure" component

KD79_and_KD80

$$RTSPPC1 = (GLPC * RTPPR - RTPPRS)$$

KD81

$$RTSPPC = \begin{cases} 1; & \text{if } RTSPPC1 < 1, \\ RTSPPC1 & \text{otherwise.} \end{cases}$$

259 "urea_handling" component

This component has no equations.

260 "glomerular_urea_concentration" component

KD53_and_KD54

$$\frac{\mathrm{d}(PLUR)}{\mathrm{d}(time)} = (URFORM - UROD)$$

261 "plasma_urea_concentration" component

KD55

$$PLURC = \frac{PLUR}{VTW}$$

262 "renal_peritubular_capillaries" component

This component has no equations.

263 "peritubular_capillary_pressure" component

KD74_to_KD77

$$RCPRS = ((RFN - 1.2) * RFABX + 1.2) * RVRS$$

264 "peritubular_capillary_reabsorption_factor" component

KD78

$$RABSPR = (((GLPC + RTSPRS) - RCPRS) - RTSPPC)$$

KD82

$$RFAB1 = RABSPR * RABSC$$

KD83

$$RFAB = RFAB1$$

KD84_to_KD86

$$RFABD1 = ((RFAB - 1) * RFABDM + 1)$$

KD87

$$RFABD = \begin{cases} 0.0001; & \text{if } RFABD1 < 0.0001, \\ RFABD1 & \text{otherwise.} \end{cases}$$

265 "sodium_and_potassium_handling" component

This component has no equations.

266 "distal_tubular_Na_delivery" component

KD34

$$DTNAI = MDFLW * CNA * 0.0061619$$

267 "Na_reabsorption_into_distal_tubules" component

KD113_to_KD115_and_KD36

$$DTNARA1 = \frac{AMNA * RFABD * DTNAR}{DIURET} * ((ADHMK - 1) * AHMNAR + 1)$$

KD37

$$DTNARA = \begin{cases} DTNARL; & \text{if } DTNARA1 < DTNARL, \\ DTNARA1 & \text{otherwise.} \end{cases}$$

268 "angiotensin_induced_Na_reabsorption_into_distal_tubules" component

KD108_to_KD111

$$DTNANG1 = ((ANM - 1) * ANMNAM + 1) * 0.1$$

KD112

$$DTNANG = \begin{cases} 0; & \text{if } DTNANG1 < 0, \\ DTNANG1 & \text{otherwise.} \end{cases}$$

269 "distal_tubular_K_delivery" component

KD101_and_KD102

$$DTKI = \frac{DTNAI * CKE}{CNA}$$

270 "effect_of_physical_forces_on_distal_K_reabsorption" component

KD99_and_KD100

$$RFABK = (RFABD - 1) * RFABKM$$

271 "effect_of_fluid_flow_on_distal_K_reabsorption" component

KD88_to_KD90

$$MDFLK1 = ((MDFLW - 1) * MDFLKM + 1)$$

KD90A

$$MDFLK = \begin{cases} 0.1; & \text{if } MDFLK1 < 0.1, \\ MDFLK1 & \text{otherwise.} \end{cases}$$

272 "K_reabsorption_into_distal_tubules" component

KD104_to_KD107

$$\frac{\mathrm{d}(DTKA)}{\mathrm{d}(time)} = \left(\frac{KODN}{VUDN} * 0.0004518 - DTKA\right) * 1.0$$

273 "K_secretion_from_distal_tubules" component

KD94_to_KD96

$$ANMKE1 = ((ANM - 1) * ANMKEM + 1)$$

KD97

$$ANMKE = \begin{cases} ANMKEL; & \text{if } ANMKE1 < ANMKEL, \\ ANMKE1 & \text{otherwise.} \end{cases}$$

KD91_to_KD93_and_KD98

$$DTKSC = \frac{\left(\frac{CKE}{4.4}\right)^{CKEEX} * AMK * 0.08 * MDFLK}{ANMKE}$$

274 “urinary_excretion” component

This component has no equations.

275 “normal_Na_excretion” component

KD35

$$NODN1 = ((DTNAI - DTNARA) - DTNANG)$$

KD38

$$NODN = \begin{cases} 0.00000001; & \text{if } NODN1 < 0.00000001, \\ NODN1 & \text{otherwise.} \end{cases}$$

276 “normal_K_excretion” component

KD103

$$KODN1 = (((DTKI + DTKSC) - DTKA) - RFABK)$$

KD103A

$$KODN = \begin{cases} 0; & \text{if } KODN1 < 0, \\ KODN1 & \text{otherwise.} \end{cases}$$

277 “normal_urea_excretion” component

KD52

$$DTURI = (GFN)^2 * PLURC * 3.84$$

278 “normal_osmolar_and_water_excretion” component

KD40_to_KD42

$$OSMOPN1 = (DTURI + 2 * (NODN + KODN))$$

KD44

$$OSMOPN = \begin{cases} 0.6; & \text{if } OSMOPN1 > 0.6, \\ OSMOPN1 & \text{otherwise.} \end{cases}$$

279 "normal_urine_volume" component

KD43

$$OSMOP1T = (OSMOPN1 - 0.6)$$

KD45

$$OSMOP1 = \begin{cases} 0; & \text{if } OSMOP1T < 0, \\ OSMOP1T & \text{otherwise.} \end{cases}$$

KD46_to_KD48

$$VUDN = \left(\frac{OSMOPN}{600 * ADHMK} + \frac{OSMOP1}{360} \right)$$

280 "actual_Na_excretion_rate" component

KD39

$$NOD = NODN * REK$$

281 "actual_K_excretion_rate" component

KD116

$$KOD = KODN * REK$$

282 "actual_urea_excretion_rate" component

KD56

$$UROD = DTURI * REK$$

283 "actual_urine_volume" component

KD49

$$VUD = VUDN * REK$$

284 "kidney_parameter_values" component

This component has no equations.