

Trotter Controls, Inc. FORT WORTH, TEXAS	<u>ENGINEERING REPORT</u>		NUMBER 0074	REVISION F
	<input checked="" type="checkbox"/>		MODEL FRDS GEN II	
TITLE FRDS GEN II - SYSTEM OPERATION PARAMETERS (TWEAKS)	BY Len Averyt	CHK'D MP	SERIAL ALL	
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REVISIONS:

Rev F: 09/29/2014 AH

- Added tweak 532 for Fuel Ferry
- Added tweak 533 for SI units
- Added 534-541 for unused

Rev E: 07/22/2010 MP

- Changed tweaks 91,93,198,377 to support GPS and RCL and allow user change of door offset angle.
- Added tweaks 516-531 for RCL and RCL door offset angle.

Rev D: MP

- Changed tweak 95, added tweaks 514-517, minor corrections.

Rev C: MP

- Added 40 to the addressed for tweak addresses 502 and above

PURPOSE:

This report cross references the Tweak number with its actual function. This includes default values.

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TWEAK IMPORTANCE:

The tweaks are used to set and modify the operational parameters of the FRDS Gen 2 system. Some of these parameters hold data like the calibration of the unit. While some tweaks can change how the unit operates in normal operation or Debug purposes. Tweaks 0 thru 501 are saved to EEPROM memory on the system.

TWEAK OVERVIEW:

(This information also appears in 9001-0011 GENII FRDS Maintenance and Troubleshooting Manual.)

Parameters are of two types:

- o single-byte values (which range in value from 0 to 255)
- o two-byte (word) values (which range from 0 to 65535).
- o The value in position zero of the tweak table indicates whether values are expressed in 1 or 2 byte format.

If the value of tweak position 0 is '1', the tweak numbers will be listed sequentially, 0, 1, 2, 3, 4, 5, and so on. If the value of tweak position 0 is '2', the tweak numbers will be listed in increments of two - 0, 2, 4, 6, 8, and so on. This value can also be toggled between 1 and 2 while in tweak mode by depressing the "LAMP TEST" switch.

To use this feature, select "Tweak Parameters" from the MAINT menu.

Use the twist selector knob to scroll the tweak numbers up or down. Push the selector to scroll rapidly 100 positions in the same direction as the last "twist".

To change (edit) the value of a tweak number, position the desired number at the top of the screen, and press the "YES" switch. If the user is authorized to change this value, Edit mode will be entered.

When in Edit mode, the value will be highlighted, and twisting the selector will change the value up or down. Pushing the selector button will change the value (by 100) in the direction of the last twist. Pressing "LAMP TEST" will change the value (by 1000) in the direction of the last twist. Pushing the selector while holding "LAMP TEST" will change the value (by 10,000) in the direction of the last twist. Note that changing a value by 100, 1000, or 10000 is only useful when changing two-byte (word) values. To zero a two-byte (word) value, see "change-immediate" mode, described below.

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When the desired value is displayed, press "YES" to accept the change and store the value in that tweak position. Pressing the "NO" switch will abort the change and leave the value unchanged.

Pressing "YES" or "NO" exits tweak edit mode and returns to tweak display mode.

Note: While the user is ALWAYS allowed to display the current value of any tweak parameter, the user is limited to changing (using Edit mode) only "unprotected" tweak values. These unprotected tweak values include areas of the Analog Calibration Table (tweak numbers 96-191), the Leakage Table (tweak numbers 10-89), and some user-changeable tweak values in the range of tweak numbers 90-95. All other tweak values (currently above tweak number 192) are considered "protected" and are only changeable with special authorization from a factory engineer.

A "change-immediate" mode is also provided. In this mode, twisting the selector knob will change the value of the parameter IMMEDIATELY, without pressing the "YES" switch to store the highlighted value. To enter "change-immediate" mode, press and hold the "YES" switch while momentarily pushing the selector button. Note that because the value is changed immediately while twisting the selector knob, pressing "NO" (abort change) has the same affect as pressing "YES" (accept change). This feature is useful for changing some system parameters (such as PWM duty cycle or GATE switch valve) while simultaneously observing their effect. Pressing the "LAMP TEST" switch while in "change-immediate" mode will ZERO the value being edited.

To exit tweak display mode, press the "NO" switch.

Programmer note: Tweak position zero, in addition to the values of 1 and 2, may also contain either a value of 9 (byte mode) or 10 (word mode). This will cause the tweak values to be displayed in hexadecimal format instead of decimal. If this value is set to 4, tweak values will be displayed in floating point format. Pressing "LAMP TEST" will toggle between byte and word mode. Pressing "RUN PUMP" will toggle between decimal and hex format. Switching from "AUTO" to "TIMER" will change to floating point display. Switching back to "AUTO" will display in hex (either word or byte) mode.

TWEAK LIST:

GENERAL TWEAKS				
Tweak	Description	Values	Factory Default	Additional Description
0	Tweak data view format	1 = byte 2 = Word 4 = Float 9 = Byte Hex 10 = Word Hex	1	Configures what format the data is displayed in.
1	Not Documented			

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GENERAL TWEAKS

Tweak	Description	Values	Factory Default	Additional Description
2	Internal use only	varies	111	Where to enter response to challenge 1. Only by factory authorized personnel. Refer to ER-0076
3	Internal use only	varies	222	Where to enter response to challenge 2. Only by factory authorized personnel. Refer to ER-0076
4	Internal use only	varies	varies	Generated number
5	Internal use only	varies	varies	Generated number
6	Checksum of EE0-0	varies	varies	Save 16bit EE xor checksum for all EE pages
7	Checksum of EE1-0	varies	varies	Save 16bit EE xor checksum for all EE pages
8	Future Use			
9	Future Use			

DUMP LEAKAGE TABLES

200 gallon area of table				
10-11	200 Menu label	200 Do not change	200	
12-13	0.5 Coverage level value	Set by Leakage calibration or factory values	-19	Gallon to dump not gallons remaining
14-15	1.0 Coverage level value	Set by Leakage calibration or factory values	10	
16-17	2.0 Coverage level value	Set by Leakage calibration or factory values	0	
18-19	3.0 Coverage level value	Set by Leakage calibration or factory values	20	
20-21	4.0 Coverage level value	Set by Leakage calibration or factory values	49	
22-23	4.5 Coverage level value	Set by Leakage calibration or factory values	9	MAX level on AT802
24-25	5.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
26-27	6.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only

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Tweak	Description	Values	Factory Default	Additional Description
28-29	6.5 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
400 gallon area of table				
30-31	400 Menu label	400 Do not change	400	
32-33	0.5 Coverage level value	Set by Leakage calibration or factory values	-26	Gallon to dump not gallons remaining
34-35	1.0 Coverage level value	Set by Leakage calibration or factory values	32	
36-37	2.0 Coverage level value	Set by Leakage calibration or factory values	31	
38-39	3.0 Coverage level value	Set by Leakage calibration or factory values	80	
40-41	4.0 Coverage level value	Set by Leakage calibration or factory values	48	
42-43	4.5 Coverage level value	Set by Leakage calibration or factory values	12	MAX level on AT802
44-45	5.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
46-47	6.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
48-49	6.5 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
600 gallon area of table				
50-51	600 Menu label	600 Do not change	600	
52-53	0.5 Coverage level value	Set by Leakage calibration or factory values	-3	Gallon to dump not gallons remaining
54-55	1.0 Coverage level value	Set by Leakage calibration or factory values	52	
56-57	2.0 Coverage level value	Set by Leakage calibration or factory values	70	
58-59	3.0 Coverage level value	Set by Leakage calibration or factory values	134	
60-61	4.0 Coverage level value	Set by Leakage calibration or factory values	22	
62-63	4.5 Coverage level value	Set by Leakage calibration or factory values	-44	MAX level on AT802

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Tweak	Description	Values	Factory Default	Additional Description
64-65	5.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
66-67	6.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
68-69	6.5 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
800 gallon area of table				
70-71	800 Menu label	800 Do not change	800	AT1002 Only
72-73	0.5 Coverage level value	Set by Leakage calibration or factory values	160	AT1002 Only
74-75	1.0 Coverage level value	Set by Leakage calibration or factory values	183	AT1002 Only
76-77	2.0 Coverage level value	Set by Leakage calibration or factory values	184	AT1002 Only
78-79	3.0 Coverage level value	Set by Leakage calibration or factory values	239	AT1002 Only
80-81	4.0 Coverage level value	Set by Leakage calibration or factory values	127	AT1002 Only
82-83	4.5 Coverage level value	Set by Leakage calibration or factory values	67	AT1002 Only
84-85	5.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
86-87	6.0 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
88-89	6.5 Coverage level value	Set by Leakage calibration or factory values	1	AT1002 Only
End of leakage table				
90	Hopper gauge bar chart selector	0 = No chart 1 = Chart	1	Sets whether a bar graph is displayed on Side loader gauges or not
91	Bit flags	2: turn on RCL (if authorized)		
92	Show during auto dump	0 = Hydraulic pressure 1 = Trajectory bar	0	

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Tweak	Description	Values	Factory Default	Additional Description
93	Door angle offset (+ or -)	(+ or -)	-7	Offset added to door angle to correct for mechanical factors of actuator
94	.25 second spin for hopper gauge mirroring	0=no mirror 20=20 counts 255=mirror, except in MAN mode	255	Number of twist counts in .25 sec to enable/disable hopper gauge mirroring of main PI display
95	Set special value, then exit tweak mode to take effect.	0 = Disable 44 = Slow learn mode 55 = Dots on 95=tinyCL	0	tw PostFuncUser

ANALOG CALIBRATION TABLES

PHOTO EYE

96-97	Photo 0 register	DO NOT CHANGE	0	
98-99		DO NOT CHANGE	450	
100-101	Photo 0 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 0 volts for photo eye. This can be user changed
102-103	Photo 4.50 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 4.50 volts for photo eye. This can be user changed
104-105	Photo 0 factory default register	DO NOT CHANGE	0	
106-107	Photo 450 factory default register	DO NOT CHANGE	2200	

ACCEL ONE

Accelerometer 1				
108-109	Accel One, -100 register	DO NOT CHANGE	-100	
110-111	Accel One, 100 register	DO NOT CHANGE	100	
112-113	Accel One, -1 G calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for -1G. This can be user changed
114-	Accel One, +1G	Set by calibration of	varies	This is the counts

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Tweak	Description	Values	Factory Default	Additional Description
115	calibration value	unit at factory. See unit birth certificate		value used for +1G. This can be user changed
116-117	Accel One, -1G factory default register	DO NOT CHANGE	1620	
118-119	Accel One, +1G factory default register	DO NOT CHANGE	2280	

ACCEL TWO

Accelerometer 2

120-121	Accel Two, -100 register	DO NOT CHANGE	-100	
122-123	Accel Two, 100 register	DO NOT CHANGE	100	
124-125	Accel Two, -1 G calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for -1G. This can be user changed
126-127	Accel Two, +1G calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for +1G. This can be user changed
128-129	Accel Two, -1G factory default register	DO NOT CHANGE	1620	
130-131	Accel Two, +1G factory default register	DO NOT CHANGE	2280	

GATE ANGLE

132-133	Gate Angle 0 register	DO NOT CHANGE	0	
134-135	Gate Angle 450 register	DO NOT CHANGE	450	
136-137	Gate Angle 0 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 0 volts for Gate Angle. This can be user changed
138-139	Gate Angle 4.50 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 4.50 volts for Gate Angle. This can be user changed
140-141	Gate Angle 0 factory default register	DO NOT CHANGE	2040	0 volt factory default number
142-143	Gate Angle 450 factory default register	DO NOT CHANGE	3540	4.50 volt factory default number

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Tweak	Description	Values	Factory Default	Additional Description
HOPPER GALLONS				
144-145	Hopper Gallons 0 register	DO NOT CHANGE	0	
146-147	Hopper Gallons 450 register	DO NOT CHANGE	450	
148-149	Hopper Gallons 0 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 0 volts for Hopper gallons. This can be user changed
150-151	Hopper Gallons 4.50 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 4.50 volts for Hopper gallons. This can be user changed
152-153	Hopper Gallons 0 factory default register	DO NOT CHANGE	2040	0 volt factory default number
154-155	Hopper Gallons 450 factory default register	DO NOT CHANGE	3540	4.50 volt factory default number
HYDRAULIC PRESSURE				
156-157	Hyd. Pressure 0 register	DO NOT CHANGE	0	
158-159	Hyd. Pressure 450 register	DO NOT CHANGE	450	
160-161	Hyd. Pressure 0 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 0 volts for Hyd. Pressure. This can be user changed
162-163	Hyd. Pressure 4.50 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 4.50 volts for Hyd. Pressure. This can be user changed
164-165	Hyd. Pressure 0 factory default register	DO NOT CHANGE	2040	0 volt factory default number
166-167	Hyd. Pressure 450 factory default register	DO NOT CHANGE	3540	4.50 volt factory default number

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Tweak	Description	Values	Factory Default	Additional Description
FOAM GALLONS				
168-169	Foam Gallons 0 register	DO NOT CHANGE	0	
170-171	Foam Gallons 450 register	DO NOT CHANGE	450	
172-173	Foam Gallons 0 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 0 volts for Foam Gallons. This can be user changed
174-175	Foam Gallons 4.50 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 4.50 volts for Foam Gallons. This can be user changed
176-177	Foam Gallons 0 factory default register	DO NOT CHANGE	2040	0 volt factory default number
178-179	Foam Gallons 450 factory default register	DO NOT CHANGE	3530	4.50 volt factory default number
24VDC (VOLT METER)				
180-181	1500 register	DO NOT CHANGE	1500	
182-183	2400 register	DO NOT CHANGE	2400	
184-185	15.00 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 15V Reading. This can be user changed
186-187	24.00 volt calibration value	Set by calibration of unit at factory. See unit birth certificate	varies	This is the counts value used for 24V Reading. This can be user changed
188-189	15.00 Volt factory default register	DO NOT CHANGE	2810	15.00 volt factory default number
190-191	24.00 Volt factory default register	DO NOT CHANGE	3280	24.00 volt factory default number
Factory modified only				
Requires super user clearance				
Tweak	Description	Values	Factory Default	Additional Description
192-	Fake Hopper Gallons	0 - ?	65535	Set larger than 9999

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193				or negative to use real hopper gallons
194	I2C Temp IC Alarm Limit	32	32	Temp alert C / Turn fans on (C:F) 127:260 / 80:176 / 75:167 / 32:90 21:70
195	I2C Temp IC Hysteresis	5	5	Temp C drop below limit / Turn fans off
196	EEprom version	varies	varies	Manually increment whenever format changes
197	Stop dump with "No Switch"	varies	101	Set to non zero if "No" switch should terminate a dump in progress
198	Protected bit flags	1:suppress ALL error messages 2:enable RCL 4:enable GPS	0	Authorization for additional-cost options
199	Internal use only		56	
Error Flags				
200-365	Error Flags	varies	varies	Storage area for errors detected by the system.
Other tweaks				
366-367	Scans per second	varies	445	Scan loops per second in auto dump mode.
368	Future			
369	Wait for scan loop timer	1	1	Set to 0 (zero) to disable wait for scan loop timer
370-371	Scan loop timer preset	8300	8300	Timer 3 value to time scan loop in auto dump 8300::445
372	Hopper gauge trace data	0 = Normal 1 = Use HG Trace	0	Uses hopper gauge to display program trace characters
373	Pilot interface VFD brightness	0 = Automatic 1-8 Manual	8	Sets brightness of Pilot interface VFD. 1 dimmest, 8 brightest. 0 auto adjusting
374-375	Integrator gain	0 = Off 1 - 9999	400	Integrator gain (reciprocal) 0 =

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GENERAL TWEAKS				
Tweak	Description	Values	Factory Default	Additional Description
		Normal		integrator off
376	Integrator Output Max	varies	20	Integrator output limited to this value (degrees)
377	Twist knob divider / resolution (1-4)	1 = 1:1 2 = 2:1 3 = 3:1 4 = 4:1 101 = Inhibit valves 111 = OpenGate -> Dump	2	Also allows auto dump valves to be inhibited.
378	Valve pulse peak		0	Solid on pulse (rest of "on"(hold) is PWM'd) (0 =NoPWM)
379	Valve pulse brake		0	Braking pulse (cycles opposing valve) after valve "off" (0=none)
380	On valve delay		20	Delay (in ms) before valve turn-on solid (not for PWM)
381	Damp gain	100=unity gain	67	Damping gain
382	Twist trajectory	0 = off 20 = 20 deg opened	0	Initial auto-open degrees for twist trajectory testing
383	Valve hold duty	0=100%; 1=50% 3=25%; 7=12% 15=6%	0	Valve hold duty cycle
384	PWM v1 brake	2=50%; 3=33% 4=25%; 5=20% 0=none	0	PWM valvel dynamic braking
385	PWM valvel peak	0= disable PWM valvel	15	Cycles of peak PWM on (rest is "hold" (rapid-pulsed))
386	PWM valvel minimum	0= disable PWM valvel	15	Minimum value of pWM duty cycle (scan loop cycles)
387	PWM valvel maximum	0= disable PWM valvel	40	Maximum value of PWM duty cycle (scan loop cycles)
388	PWM valve 1 total		70	Total scan loop cycles for valve 1 PWM
389	Lower limit of V1 PWM (degrees)		2	

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Tweak	Description	Values	Factory Default	Additional Description
390	PWM upper limit		10	
391	Valve1 upper limit		15	
392	Valve2 upper limit		0	
393	Valve1+2 upper limit		20	
394	Valve4 upper limit		35	
395	Valve1+4 upper limit		0	
396	Valve2+4 upper limit		0	
397	Valve1+2+4 upper limit		100	
398-399	Next index to save error in		0	
400-449	Last x errors, max error number ErrMax		Varies	
450	Valve to use when Gate/open close switch used	1 2 4	1	Selects valve combination to use when in Auto or Timer modes using the Gate Open or Closed switch
451	Speed to open/close Gate in timer dump	1 2 4	2	Selects valve combination to use when in Timer mode
452	Number of exercise pulses for Bleed and E-Dump valves	5	5	Sets number of pulses each of the valves receive.
453	Hydraulic Pressure and Gate Angle log time	100	100	Log Hydraulic Pressure and Gate Angle (1/100th sec)
454	Hopper Gauge bandwidth filter adjust	1=1/3 2=1/6 3=1/9 4=1/12	2	Adjusts hopper gauge filtering and display speed bandwidth
455	Accelerometers disable / Manual adjust	0 = Normal 100 = 1G 200 = 2G	0	Set nonzero to disable accelerometers
456	I2C bus read inhibit	0 = Normal 1 > Inhibited	0	Set nonzero to inhibit I2C reads (debug)
457	Close Gate slow down angle	45	45	Angle at which Gate slow down is enabled.
458-459	Inject foam default time	10	10	Default seconds to inject foam when selected
460-461	Aircraft index	0=802,1=1002 3=502, 3=602	0	AT Aircraft configuration index
462-463	Hardware index	first=0	0	Aircraft hardware configuration index
464-	Timer mode open gate	Varies	Varies	Operator set time to

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GENERAL TWEAKS				
Tweak	Description	Values	Factory Default	Additional Description
467	time			open Gate
468-471	Timer mode open gate duration time	Varies	Varies	Operator set time to leave Gate open
472-473	Index in of Coverage Level Step	1=lowest 9=highest	9	(default is highest) fCoverageLevelStep[]
474-475	Index in of Gallons to dump	Varies	0	(default is PILOT) DumpGal
476-491	Dynamic tweak number, if nonzero		0	
492-499	Dynamic tweak value		0	
500-501	Length of unprotected tweak area		192	
502-503	Low pressure LED trigger if PSI < 2200		2200	System test trigger value
504-505	If ARMED and pressure < 2700 turn pump on		2700	System test trigger value (pump on=3.8V)
506-507	If not ARMED and pressure < 2520 turn pump on		2520	System test trigger value (pump on=3.5V?)
508-509	If pressure > 3050 turn pump off		3050	System test trigger value (pump off=4.0V)
510-511	LCD line spacing (main, alt LCDs)		16,8	Pixels per line
512-513	LCD font height (main, alt LCDs)	8=50%, 12=75% 16=full	16,8	character height in pixels
514	LCD optimization level	0, 1, 2	1	Allow LCD optimization if not zero.
515	LCD refresh Time. Seconds to refresh LCD with new data.	0, 2-60	30	(0:no refresh) (1:reserved)
516	Default ground speed		103	For RCL
517	Close speed5 angle. If angle at start of autodump close is less than this, initial close speed set to 5 (not 7).	(see tw457)	0	(0=don't use this feature)
518	Swath width (feet)		33	For RCL
519	Reserved			
520-521	Gallons per acre		1000	For RCL
522-531	10 values for RCL door offset angle			Offset corresponds to C.L. = .2 to 1.0 and 1.5

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**FRDS GEN II - SYSTEM OPERATION
PARAMETERS (TWEAKS)**

BY **CHK'D**
Len Averyt MP
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GENERAL TWEAKS

Tweak	Description	Values	Factory Default	Additional Description
532	Fuel Ferry boot flag	0,1	0	When set to 1 the PI will boot in Fuel Ferry Mode
533	Metric Display	0,1,2		0 - English, 1 - SI unit with English coverage, 3 - All SI
534	Unused			
535	Unused			
536	Unused			
537	Unused			
538	Unused			
539	Unused			
540	Unused			
541	Unused			

FOLLOWING AREA NOT SAVED TO EEPROM

542-543	EE Page Zero padding	0	0	Padding at end of last EE page for space
574	SYSTEM CLOCK timer	Varies	NA	Clock ticks since boot up (max value 262144~72hours)
578	Checksum Accumulator math area (EE0a)	Varies	NA	checksum accumulator area (16bit) XOR...
579	Checksum Accumulator math area (EE1a)	Varies	NA	...occupies 2 byte values
580	Dummy EE read		0	Set nonzero to perform dummy EE read (calculate checksum only)
581	Push knob increments	varies	100	Incremental value per push
582	EE page to start with		0	
583	EE page to Save/Read		17	Last EE page+1 to save/read (cur 17) (set at MAIN start)
584	EE Bank read select	0 = Bank0 1 = Bank1	0	bank0 or bank1 to read (for redundancy)
585	Memory bank Select	0=Ext 1=Int 2=Both(Wt) 2=Int(aCal) (Rd)	0	Ext = External Int = Internal WT = Write aCal = Analog Calibration

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GENERAL TWEAKS				
Tweak	Description	Values	Factory Default	Additional Description
		3=Ext (leak) (Rd) 4=Int (leak) (Rd)		Rd = Read
586	Display type	1=LCD, 0=VFD	0	Auto select at boot
587	Read Bad EE	0	0	Set nonzero to allow read of EE data even w/bad checksum
588	EE compare bitmask	01=ext.A 02=ext.B 04=int.A 08=int.B		Ext = External Int = Internal
589	Write EE after fail	0	0	Set nonzero to allow EEwrites even after Eeread fail
590	Write Bad checksum (debug)	0	0	Set nonzero to deliberately write EE w/bad checksum
591	Secondary error code for error 160:	0	0	Write(codes:1,2,...)
592-595	Integrator total error	Varies	0	Integrator total error accumulator
596-597	Scan loops/sec when Lamp Test or YES switch last turned on	Varies	0	
598	Trigger MPU errors	1:WD 2:Multi 3,4:Math >=5:recurs on Logo display	0	
599	Current Noritake (PI Display) brightness level	1 to 8	Varies	
600	Proposed new Noritake (PI Display) brightness level	1 to 8	Varies	
601	GATES SWITCH scan loop cycles for valve 1 pwm	255 = Off	255	
602	PWM brake count		0	PWM brake count (150,125,112% of on count) using opposite valve
603	Read I2C temp IC time delay		5	Seconds between temp readings. This prevents heating the sensor from use.

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GENERAL TWEAKS

Tweak	Description	Values	Factory Default	Additional Description
604-605	Integration Cycles		0	Number of cycles in this integration
606-611	Cycles remain for peak or brake (open421,clos421)		0	
612	Tweak Post Function code:	11 = Write Fan Limits 22 = Bulk Calibrate 99 = LOCKUP	17	
613	Bulk analog calibration selection bits	bit0 = photo bit7 = battery	248 (F8)	
614	Bulk analog calibration	0=low 1=high	1	Allows analog calibration of all points simultaneously
615	Mirror Pilot Interface to Hopper Gage (Side loader gages)		0	Set to 1 to mirror PI to HG. 255=disable for this boot only
616	Supervisor inhibit frequency	50=1Hz 33=1.5Hz 25=2Hz 16=3Hz 12=4Hz 5=10Hz	25	
617	Inhibit Supervisor	0 = Normal 1 > Inhibit	0	Set nonzero to toggle 2Hz "inhibit Supervisor" output
618-619	Angle when auto dump starts fast gate close		0	(display only)
620-621	Leakage table 1st index used for dump		0	(display only)
622-623	Leakage table 2nd index used for dump		0	(display only)
624-625	Expected gallons remaining after dump		0	(display only)
626-627	Leakage to use for most recent dump		0	(display only)
628-629	Duration of last gate open/close switch		0	(ticks)
630	Pad (unused)		N/A	
631	Previous dump ALL?		0	(display only)
632-633	Duration of last auto dump		0	(1/100ths sec)
634	O-scope ValveSpare2		0	Set nonzero to toggle ValveSpare2 each scan

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GENERAL TWEAKS				
Tweak	Description	Values	Factory Default	Additional Description
				loop. For o-scope
635	Pad (unused)		N/A	
636- 637	Premature timer3 counts			Counts of premature timer3 pops in auto dump scan loop
638- 639	Seconds captured for adumpSPS, premPops		0	Number of full seconds captured in adumpSPS[10],prempops[10]
640- 659	BUFFER AREA 10, 1 Second, Scans per seconds buffer		0	10, 1-sec, scans per Second captured in auto dump.
660- 679	BUFFER AREA 10, 1 Second, premature pops		0	10, 1-sec, cumulative Premature Pops captured in auto dump.
680- 681	Gallons in hopper at start of learning dump		999	
682- 683	Gallons in hopper at end of learning dump		999	
684- 685	MAN SALVO message disable	0 = Normal 1 > Disable	0	Disable MAN SALVO message Set nonzero to disable
686- 687	MAN SALVO condition exists at boot		0	
688- 699	Degrees moved for each valve		0	System test Valve Connection Test
700- 731	Persistent errors		N/A	32 bytes of persistent data saved by Systest
732- 733	Fake gallons remaining		-1	Fake gal. remaining (for learn) if non-neg
734	Fake good Systest. Valve connection test	0	0	Set nonzero if faking a good Valve connection test
735	Valve opening time (1/100 sec)		20	How long to open valves in systest valve connection
Variables after this point are tweak-addressable if needed				
736				Multiple of 4 for later floats

In the listing below, tweak values preceded with "uc" and "ch" are single-byte values, while tweak values preceded with "ui" and "si" are double-byte (word) values.

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//TWEAKS TABLE STARTS HERE
// FOLLOWING AREA SAVED TO EEPROM -- CAN BE MODIFIED BY ANY USER
=====
ui tweakEntrySize=1; //tw0 // format (1=byte 2=word 4=float 9=byteHex 10=wordHex).
uc twResponse1=111; //tw2//set by super-user in response to challenge to allow
uc twResponse2=222; //tw3// full access to tweak area
ui twChallenge=0; //tw4//this value randomly set at tweak entry to challenge super-user
uc cksumEE0=0; //tw6 // save 16bit EE xor cksum for all EE pages
uc cksumEE1=0; //tw7
uc pad_8=0; //tw8 //FOR FUTURE USE
uc pad_9=0; //tw9 //FOR FUTURE USE
si intLeakage[LeakRowMax+1][LeakageCols]={{}; //tw10 //(4x10 array)
// tw10 200gal area of table (galToDump, not GalRemain)
// tw30 400gal area of table
// tw50 600gal area of table
// tw70 800gal area of table
uc userFlags=0; //tw90 //bit flags (see below)
#define hgbarchart 1 //bit0=0 if no HG (sideloader) bar chart desired
#define foamArmNag 2 //bit1=1 if ARMED SW nag msg in foam inject
#define slashZero 4 //bit2=1 if keep zeros slashed
#define noAutoHilite 8 //bit4=1 if NO auto highlight in Auto and Timer screens
#define noAutoEdit 16 //bit5=1 if NO auto edit in Auto and Timer screens
#define NoSysTestSv 32 //bit3=1 if bypass save EEPROM after systest
uc keepForce=0; //tw91 //set to 99 to allow DigiOut "forces" to persist
// userFlags2 bit definitions:
#define trajbar 1 //bit0=1 if trajectory bar during autodump, bit0=0 if hydPres
#define noSidLodr 2 //bit1=0 if sideloader, bit1=1 if NO sideloader
#define SidLodrLCD 4 //bit2=1 if LCD sideloader, bit2=0 if VFD sideloader

uc userFlags2=0; //tw92 // hydPres, VFD display
uc twistScale=2; //tw93 //twist divider (1-4) to make twist knob less sensitive

uc spinMirror=255; //tw94 //(0.25sec spin) 0=disable mirror 20=enable spin 255=use MAN sw
uc twPostFuncUser=0; //tw95 //44=LeakSlowLearnMode //55=dotsOn
si intAnalogCalib[8][6]= //32byte boundary //tw96-191 (PAGES 3,4,5)
    { // V10*100, Vhi*100, currCtLo, currCtHi, factCtLo, factCtHi
// NEW VALUES FOR ANALOG CAL FACTORY VALUES (start with v1.11)
/* tw96 Photo*/          {0,450,0,2200,0,2200}, //tw100,102
/* tw108 AccelOne*/      {-100,100,1620,2280,1620,2280}, //tw112,114
/* tw120 AccelTwo*/      {-100,100,1620,2280,1620,2280}, //tw124,126
/* tw132 GateAngle*/    {0,450,2040,3540,2040,3540}, //tw136,138
/* tw144 HopperGal*/    {0,450,2040,3540,2040,3540}, //tw148,150
/* tw156 HydPres*/      {0,450,2040,3540,2040,3540}, //tw160,162
/* tw168 FoamGal*/      {0,450,2040,3530,2040,3530}, //tw172,174
/* tw180 Batt24v*/      {1500,2400,2810,3280,2810,3280}, //tw184,186
    };
// FOLLOWING AREA SAVED TO EEPROM -- CAN BE MODIFIED ONLY BY A SUPER USER
=====
// tw192
ui fakeHG = 65535; //tw192 //set larger than 9999 (or neg) to use real HG
uc I2CtTLimitMsb = 32; //tw194 temp alert (degC) (C:F): 127:260 80:176 75:167 32:90 21:70
uc I2CtHystMsb = 5; //tw195 temp hysteresis drop below TLimit
uc EEver=9; //tw196 // EEprom version (manually incr whenever format changes)
uc stopDump=101; //tw197 set non-zero if NO sw should terminate Dump
uc noErrs=0; //tw198 //set nonzero to suppress ALL error messages
uc chalBypass=56; //tw199 //set to 55 to bypass challenge/response
// tw200
uc cErr[ErrMax+1]={}; //tw200 //error flags, pos 0:# of active errors
// tw366
ui scanPerSec=445; //tw366 //scan loops per sec in auto dump mode. (see scanLoopTmr)
ch SysTestStep=0; //tw368 //initial step into SysTest if nonzero (-5 to 127)
uc scanWait=1; //tw369 //set zero to disable wait for scan loop timer
ui scanLoopTmr=8300; //tw370 //timer3 value to time scan loop in autodump 8300::445

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uc HGtrace=0; //tw372 //set nonzero for trace chars on HG
ch britePI=8; //tw373 //brightness adjust value for PI VFD (auto=0,man=1-8)
ui integGain= 400; //tw374 //integrator gain (reciprocal) //0=integrator off
uc integOutMax= 20; //tw376 //integrator output limited to this value (degrees)
ch angleTwk= -7; //tw377 //gateAngleTweak(+or-) 101=inhibitAutodumpValves 111=OpenGate->DUMP
uc vPulsePeak=0; //30; //tw378 //solid on pulse(rest of "on"(hold)is PWM'd) (0=NoPWM)
uc vPulseBrake=0; //15; //tw379 //braking pulse(cycles,opposing valve) after valveOff (0=none)
uc OnValveDelay= 20; //tw380 //delay (in ms) before valve turn-on solid (not for PWM)
uc DampGain=67; //tw381 //damping gain 100=unityGain
uc TwistTraj= 0; //222; //tw382 //initial auto-open degrees for twist traj testing (0=off)
//      Next "duty" value controls both V1-fractional-PWM and all-valve-"hold"-PWM
uc HoldDuty= 0; //3; //tw383 //valve hold duty cycle (0=100% 1=50% 3=25% 7=12% 15=6%)
uc PWMv1Brake= 0; //3; //tw384 //PWM valve1 dynamic braking (2=50%,3=33%,4=25%,5=20% 0=none)
//      Next 3 values=0 to disable PWM valve 1
uc PWMv1Peak= 15; //tw385 //cycles of peak PWM on (rest is "hold" (rapid-pulsed))
uc PWMv1Min= 15; //tw386 //minimum value of PWM duty cycle(scan loop cycles)
uc PWMv1Max= 40; //tw387//maximum value of PWM duty cycle(scan loop cycles)
uc PWMv1Tot= 70; //tw388 total scan loop cycles for valve 1 pwm

uc PWMerrMin = 2; //tw389 //lower limit of V1 PWM (degrees)
uc slider0 = 10; //000 0 //tw390 PWM upper lim
uc slider1 = 15; //001 1 //tw391 valve1 upper lim
uc slider2 = 0; //010 2 //tw392 valve2 upper lim
uc slider3 = 20; //011 3 //tw393 valve1+2 upper lim
uc slider4 = 35; //100 4 //tw394 valve4 upper lim
uc slider5 = 0; //101 5 //tw395 valve1+4 upper lim
uc slider6 = 0; //110 6 //tw396 valve2+4 upper lim
uc slider7 = 100; //111 7 //tw397 valve1+2+4 upper lim

si intErrHistIndex=0; //tw398 //next index in uErrHist[] to save error
// tw400
uc uErrHist[ErrHistLen]={}; //tw400 //last x errors, max error number ErrMax
// tw450
uc manuValve = 1; //tw450 // valve to use (1,2,4) when gate/open close switch used
uc DumpTimerSpeed = 2; //tw451 //speed to open/close Gate in timer dump
uc unStick=5; //tw452 //number of EXTRA pulses to unstick a potentially stuck valve
uc LogTick=100; //tw453 //log hydPres and GateAngle (1/100th sec)
uc HopperBW=2; //tw454 //hopperGauge bandwidth filter adjust: 1=1/3 2=1/6 3=1/9 4=1/12
uc fixdAccel=0; //tw455 //set nonzero (100=1G,200=2G) to disable accelerometers
uc NoI2Creads=0; //tw456 //set nonzero to inhibit I2C reads (debug)
uc GateCloseSlowAngle =45; //tw457 //closeGate angle to slow down
si FoamSecs=10; //tw458 //seconds to inject foam
si cAircraftIndex=0; //tw460//index in cAircraft[] of configured
aircraft (AT802,AT1002,AT502,AT602)
si cHardwareIndex=0; //tw462//index in cHardware[] of configured hardware, first=0
fl fDumpTimerOpening = 1.0; //tw464//operator sets time to open Gate
fl fDumpTimerOpened = 0.0; //tw468//operator sets time to leave Gate open
si intCoverageLevelIndex = 9; //tw472 //index in fCoverageLevelStep[] (default is highest)
si intDumpGalIndex = 0; //tw474 //index in 'gallons to dump', DumpGal (default is PILOT)
# define numDynTw 8 //number of dynamic tweak entries
ui dynTwNum[numDynTw]={0}; //tw476 //dynamic tweak number, if nonzero
uc dynTwVal[numDynTw]={0}; //tw492 //dynamic tweak value
ui tweakUnprotLen=192; //tw500 //length of unprotected tweak area

ui HydPresLoLt=2500; //tw502 // low pres LED trigger (was 2500, then 2200)
ui HydPresOnAr=2700; //tw504 //if Armed and pres < 2700 turn pump on
ui HydPresOnNa=2520; //tw506 //if NotArmed and pres < 2520 turn pump on
ui HydPresOff=3050; //tw508 //if pres > 3050 turn pump off

uc pad_510[32]={0}; //tw510 padding for future use

// FOLLOWING AREA **NOT** SAVED TO EEPROM
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uc EEpads[32]={0}; //tw542 //insure zero padding at end of last EE page
// SYSTEM CLOCK: time in 100ths sec; 11 min counter (actually 10min+55.36sec)
ul ticks=0; //tw574 SYSTEM CLOCK timer ticks since boot up
uc cksumEE0a=0; //tw578//chksum accum area (16bit) XOR...
uc cksumEE1a=0; //tw579//...occupies 2 byte values
uc EEpreRead=0; //tw580//set nonzero to perform dummy EE read (calc cksum only)
uc manBump=100; //tw581 //in twistTrajectory mode, how many degrees per pushbutton
uc EEsaveStart=0; //tw582//EE page to start with
uc EEsavePg = 17; //tw583//last EE page+1 to save/read (cur 17)(set at MAIN start)
uc EERedunBank=0; //tw584 //bank0 or bank1 (redundancy) to read
uc EEintExt=0; //tw585 //0=Ext 1=Int 2=Both(Wrt) 2=Int(aCal)(Rd) 3=Ext(leak)(Rd) 4=Int(leak)(Rd)
uc pad_546=0; //tw586
uc EEBadCksumRd=0; //tw587//set nonzero to allow read of EE data even w/bad cksum
uc cmpMask=0x0f; //tw588 //EE compare bitmask 01=ext.A 02=ext.B 04=int.A 08=int.B
uc EEwriteAllow=0; //tw589 // set nonzero to allow EEwrites even after EERead fail
uc EEcksumSeedW=0; //tw590//set nonzero to deliberately write EE w/bad cksum
uc cSecErr=0; //tw591 //secondary error code for error 160:write(codes:1,2,...)
sl integAccum=0; //tw592 //integrator total error accumulator
ui scanYPerSec=0; //tw596//scan loops/sec when lampTest or YESsw last turned on
uc WDtest = 0; //tw598 // trigger MPU errs 1:WD 2:Multi 3,4:Math >=5:recurs on Logo display
ch cLightLevelCurr = Brightest+1; //tw599 //current Noritake brightness level, 1 to 8
ch cLightLevelPros = Brightest; //tw600 //proposed new Noritake brightness level, 1 to 8
uc PWMv1GateSw = 255; //tw601 // GATESWITCH scan loop cycles for valve 1 pwm (255=off)
uc PWMbrakeCnt=0; //tw602 //PWM brake count (150,125,112% of on count) using opposite valve
uc tempTimer=5; //tw603 //seconds between temp readings (don't heat the sensor)
ui integCycles=0; //tw604 //number of cycles in this integration
uc valvePulse[6]={0}; //tw606-611 //cycles remain for peak or brake (open421,clos421)
uc twPostFunc=17; //tw612 //tweak postFunction code: 11=wrtFanLimits 22=bulkCalib 99=LOCKUP
uc bulkCalSel=0xf8; //tw613 //bulk analog cal selection bits:(bit0=photo bit7=batt)
uc bulkCalLoHi=1; //tw614 //bulk analog cal 0=low 1=high
uc mirrorPI = 0; //tw615 //set to 1 to mirror PI to HG. Set to 255 to disable mirror for this boot
uc inhibitFreq=25; //tw616 // inhibit Supv freq 50=1Hz 33=1.5Hz 25=2Hz 16=3Hz 12=4Hz 5=10Hz
uc inhibitSupv=0; //tw617 //set nonzero to toggle 2Hz "inhibit Supv" output
si GateFastCloseStart=0; //tw618 //angle(display only) when autodump starts fast gate close
ui LeakageRow=0; //tw620 //Leakage table 1st index used for dump(display only)
ui LeakageCol=0; //tw622 //Leakage table 2nd index used for dump(display only)
si DumpGalRemainExp=0; //tw624 //Expected gallons remaining after dump(display only)
si LeakageUse=0; //tw626 //Leakage to use for most recent dump(display only)
ui manuTicks=0; //tw628 //duration of last gateopen/close sw (ticks)
uc pad_590=0; //tw630
uc cDumpAllPrev=0; //tw631 // previous dump ALL? (display only)
ui doorOpenTimer=0; //tw632 //duration (1/100ths sec) of last auto dump
uc scanScope=0; //tw634 //set nonzero to toggle ValveSpare2 each scanloop for o-scope
uc curEEver=0; //tw635 //cur EE version from software (set at boot)
ui premPop=0; //tw636 //count of premature timer3 pops in autodump scan loop
ui ndxSPS=0; //tw638 //number of full secs captured in adumpSPS[10],premPops[10]
# define numSPS 10 //number of 1-sec scansPerSec entries
ui adumpSPS[numSPS]={0}; //tw640 //10 1-sec scansPerSec captured in autodump
ui premPops[numSPS]={0}; //tw660 //10 1-sec cum premPops captured in autodump
si hopStart=999; //tw680 //gal in hopper at start of learning dump
si hopEnd=999; //tw682 //gal in hopper at end of learning dump
ui disableManSalvo=0; //tw684 //disable MAN SALVO msg
ui bootManSalvo=0; //tw686 //MAN SALVO condition exists at boot
si saveValveMoves[6]={0}; //tw688 //degrees moved for each valve (systestValveConn)
//tw700
uc PersistEE[32]={88,88,0}; //tw700 32 bytes of persistent data saved by SysTest
#define err021 PersistEE[0] // error 021 (88 indicates no error)
#define err105 PersistEE[1] // error 105 (88 indicates no error)
si fakeGrem=-1; //tw732 //fake gallons remaining (for learn) if non-neg
uc fakeVConn=0; //tw734 //set nonzero if fake good SysTestValveConn
uc ValveConSec = 20; //tw735 //how long to open valves in systest valveConn (1/100th sec)

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```

// ANY INITIALIZED VARIABLES AFTER THIS POINT ARE TWEAK-ADDRESSABLE, IF
NEEDED.=====
// tw736 MULTIPLE OF FOUR for later floats

float fTimeSec = 0.0; //SYSTEM CLOCK seconds since start up(max value 262144~72hours)

```