Report Logger Design Specifications
Last Revised 1/21/10

DESIGN SPECIFICATIONS

Product Name:	Dickson Report Logger
Created by:	Kelly Giardino
Approved by:	
Product Model:	RL100
Product Revision:	REV 6.0

1) Project Contacts

Sponsor

Contacts	Title	Phone	E-Mail
Fred Kirsch	VP Manufacturing	630.563.4250	fkirsch@dicksondata.com
Kelly Giardino	Engineering Project Coordinator	630.563.4252	kgiardi@dicksondata.com
Dean Tjaden	Software Engineer	630.563.5254	DTjaden@dicksondata.com

Developer

Contacts	Title	Phone	E-Mail
Wang Tao	Engineer		wtao@dicksondata.com
Wei Liu	Project Manager		lliu@dicksondata.com

2) Reference

Dickson will provide the following documents for the Report Logger development

Design Specifications	This Document	pp. 1-7
Output Graph	Attached	pp. 8-16
Operational Flow Charts	Attached	pp.17-18
Product Drawing	Attached	p. 19
PCB Drawing	Attached	p. 20
Detailed Specifications	Attached	pp. 21-22
Component Specification Sheets	Attached	pp. 23-28

3) Project Summary & Models

a) The Report Logger is a mass storage device, with factory selectable sample rate and sample time.

b) When connected to a PC USB port Windows will run Auto Play, find the executable program on the logger and run it. The .exe file on the logger must be an Autoplay Program.

c) The executable file will open a graphing object in a window that will populate with logged data currently saved on the logger

d) The graph object will allow the user to Print the graph, Save graph as a Read Only PDF, .jpg or text file table, Clear Logger or Exit (without clearing).

e) Clearing the logger will delete saved logged data and reset the start time, UCT offset, date, and counter

f) Logged data is saved when power is lost.

g) A battery level indicator is included on in the program window and clearing Logger will trigger a voltage calculation to determine if the logger has enough power to log for the duration of the logging time. If the logger voltage is "low" user will be asked to recharge or replace battery. (Note: See Section 10 Power Source below.)

h) Key considerations:

i) This is not a HID device – it is a Mass Storage device

ii) A US232 Port and a System Block are required for calibration and factory setup

iii) The graph object must be approved by Dickson

Model	Description
RL100 Features	1. The RL100 is a temperature only logger: • Mass Storage Device • Set Sample Rate – Sample Rate dependent from 1 to 9 minute intervals depending on Sample Period (total amount of time logger will take samples before stopping) – Factory Selectable • Power Source: See Power Options section 10 • Onboard graphing object will allow user to View/Save/Print graph and Clear logger • Logs data in F - documentation displays data in F & C • Ambient Operating Conditions: -40 to 176F (-40 to 80C); 0 to 100% RH • Temperature Accuracy: +/-1.8F (1.0C) Full Scale (non condensing) • USB Download • Logging Periods (in days): 1, 3,7, 10, 20, 40, 75, 90 • Logging Periods to be selected via a recessed button on the pcb. Default on a new logger is 1 Day. Press button to scroll through all logging periods. Each logging period is indicated by a blink (1 blink = 1 day, 3 blinks = 3 day, etc.) • Total Sample Points: must be ≥(15,428 + system block). Loggers will stop logging at a specific number of sample points depending on the sample period selected.
RL100 Logging Time & Sample Rate	2. Logging Time / Sample Rate / Sample Points Used before STOP ▪ 1 Day / 1 Minute / 1,440 ▪ 3 Day / 1 Minute / 4,320 ▪ 7 Day / 1 Minute / 10,080 ▪ 10 Day / 1 Minute / 14,400 ▪ 20 Day / 2 Minute / 14,400 ▪ 40 Day / 4 Minute / 14,400 ▪ 75 Day / 7 Minute / 15,428 ▪ 90 Day / 9 Minute / 14,400

4) Pricing

a) **Cost not to exceed $15.00 for complete unit.** Includes case, sensor, PCB assembly, battery and packaging.

5) Objectives

PROJECT OBJECTIVES:
• Produce a cost effective product that is easy to assemble, program, and use.

TECHNICAL FUNCTION & PERFORMANCE OBJECTIVES
• Unit has a standard logging capacity of ≥(15,428 + system block) sample points with set sample rates to be selected via a button on the pcb at the factory. Sample points used depends on the recording time selected. For Example: Logger needs to know that a 1 day sample period with 1 minute sample rate will stop logging after 1,440 samples have been recorded. See RL100 Logging Time & Sample Rate above. • Use a Thermistor – isolated from PCB • A/D converter should be onboard Microprocessor. • Logger can only be cleared via program Clear Logger command or Calibration command. Logged data is saved when power is completely lost. • Connecting the logger to USB does not stop logging if logger is not full. • Only one instance of the logger program can be allowed to run at a time.

- User can not write to or copy from the logger directory

MANUFACTURING OBJECTIVES:
• Use common easily substituted components whenever possible. • Factory calibration of sensor using a serial connection. • Avoid using end of life components.

6) Existing Methods and Procedures
Developer will incorporate USB, Calibration and Logging modules. Files can be copied from old version Flatscreen code.

dean.c
main_usb.c
comm.c
comm.h
dean.h
defs.h
spieeprom.h
spieeprom.c
plus some routines in main.c

****DicksonCommProtocol (what data and where data is written to the logger) Per Dean Tjaden**

Review flowcharts

7) Components

Components	Proposed
Sensors	Thermistor - 188006 See Attached Spec
Battery	TBD – See Section 10 Below: Power Source Options
USB Jack	Try to use PCB as plug in connector for USB
Microprocessor	Start with: Atmel USB – must be approved by Dean Tjaden - Look into U3 USB Protocol
A/D Converter	Must be on board (internal to) microprocessor.
LED	Digi Key Number 350-1357-1-ND See Attached Spec

8) Operation and Workflow: Alarm, Power, Data Storage

Alarms Type	Low Battery: Red LED Each logger will hold two low power alarm thresholds based on logger status: i) Logger is currently logging: Logger has reached a low voltage level that will not allow the logger to reach the end of the logging period. Red LED will blink. ii) Logger is connected to PC, executable is running, window with graph has been opened. The user now wants to CLEAR LOGGER. If the voltage level is below the required level to allow the logger to log for the entire duration of the loggers preset logging time eg (1 day, 40 days, 90 days etc.) then a warning should pop up stating that the logger can not be cleared until the logger has been recharged or the battery has been replaced (this is dependent upon the power sources selected). The LED will remain solid red while plugged into USB. When disconnected from USB the LED will blink Red if condition 1 above is also met. NOTE: The Variables required to determine the required level include: Current Voltage, Current Temp, Target Temp (-40F), Logging Time, Sample Rate.
Power	Type: See #10 Below: Power Source Options Logger is always on but not always logging. When plugged into USB port, unit should draw power from USB. If power is lost, logged data will be saved.
Logging	Not logging when the following conditions exist: 1- Logger is full (always in stop when full mode) 2- Logger has been cleared and reset on PC and the START button has not been pressed. 3- No Power Logging when the following conditions exist: 1- The logger has been cleared and the START button has been pressed.
Temperature	**Must be a Signed Integer: Degree F x 10**
LED	Blink Rate: Depends on Status Green Blink: give a clearly visible flash every 10 seconds: Logger logging Red Blink: give a clearly visible flash every 10 seconds: Low Power – Not connected to USB Green Blink: give 5 clearly visible blinks; When Logger has been cleared and Start button has been pressed Green Solid: when connected via USB and there is not a low power alarm Red Solid: when connected to USB and there is a low power alarm Off Solid: when logger has been cleared and is ready to log, or there is not power at all to unit.
Push to Start	Press and Hold down button for 3 seconds to activate start.

9) Calibration

Calibration:	Zero, Span, Autocal No user calibration
Calibration Header:	5 Pin Right Angle – Thermistor sensors must be within accuracy specification to limit the need for factory calibration

10) Power Source – Two Options:
   a) The unit should not be more than 1.5" wide. This should allow us to use most coin cell batteries. We would like to consider two power options:
      i) **User Replaceable Battery:** Based on the specifications, what is the best battery life you can estimate based off the following functional parameters:
         (1) 7 minute sample rate for 75 days / 9 minute sample rate for 90 days
         (2) -40F operating temperature
         (3) Unit powers off USB while downloading to PC
         (4) Estimate that LED will give a clearly visible flash every 10 seconds.

      ii) **Super Cap**: Based on the specifications, what is the best power life you can estimate based off the following functional parameters:
         (1) 7 minute sample rate for 75 days / 9 minute sample rate for 90 days
         (2) -40F operating temperature
         (3) Unit powers off USB while downloading to PC
         (4) Estimate that LED will give a clearly visible flash every 10 seconds.
         (5) Super cap would be recharged off PC USB port (Note: Needs to be approved by Dickson.)

11) Safety, Regulatory and Environmental Requirements

SAFETY REQUIREMENTS:
CE Compliant

REGULATORY & ENVIRONMENTAL REQUIREMENTS (weight, volumes, materials, disposal):
Lead Free – ROHS, FCC Part 15 Compliant IP65

12) Interface
   Operating Interface Definition (see "View Drawings")

13) Test Plan
   - Before sending samples to Dickson for evaluation, all functions should be tested by the developer against submitted operation instructions. Any known operational problems should be noted before sending to Dickson.
   - Current Draw Test
   - Full Functional Test: Should be able to operate unit according to operational manual and work flow charts.
   - Calculate battery life at room temperature.
   - Determine how low of a voltage the unit will function at.
   - All features should function without requiring reset when changed.
   - Developer should supply diagnostic code for the PCB assembly
   - Developer should write functional test procedures

14) Development Plan
   Project personnel and responsibilities

   Dickson
   - Dickson will decide responsibility for:
      - Mechanical Engineering, Procurement, Testing and Assembly
   - Dickson will provide:

  - Basic size parameters for PCB
  - General Location of feature components
- Required Elements that are subject to Dickson approval:
  - How the calibration constants are applied
  - Microprocessor
  - All major PCB Assembly Components
  - All Sensors
  - Evaluation of PCB Assembly Performance, Source Code and PC Software
  - All firmware and schematics must use same IDE.
  - Software used for Layout, Gerbers and BOM's must be the same type and version as Dickson's (PDF files will not be accepted)
  - Approval of Micro

Developer

- Developer is responsible for the following:
  - Designing (including providing dimensional drawings and source code) the PCB and PCB assembly for the indicator
  - Determining cost for complete PCB Assembly
  - Providing Dickson with weekly updates on project progress and supplying samples (including source code) for evaluation and testing
  - Written diagnostic code for the PCB assembly
  - Written functional test procedures
- Any deviations from the outlined functionality (buttons, display, features, etc) or overall appearance need to be approved by Dickson prior to submission of any component for evaluation.
- A written document containing your interpretation of the unit functionality features and general appearance needs to be submitted to Dickson prior to the start of any hardware or software development.

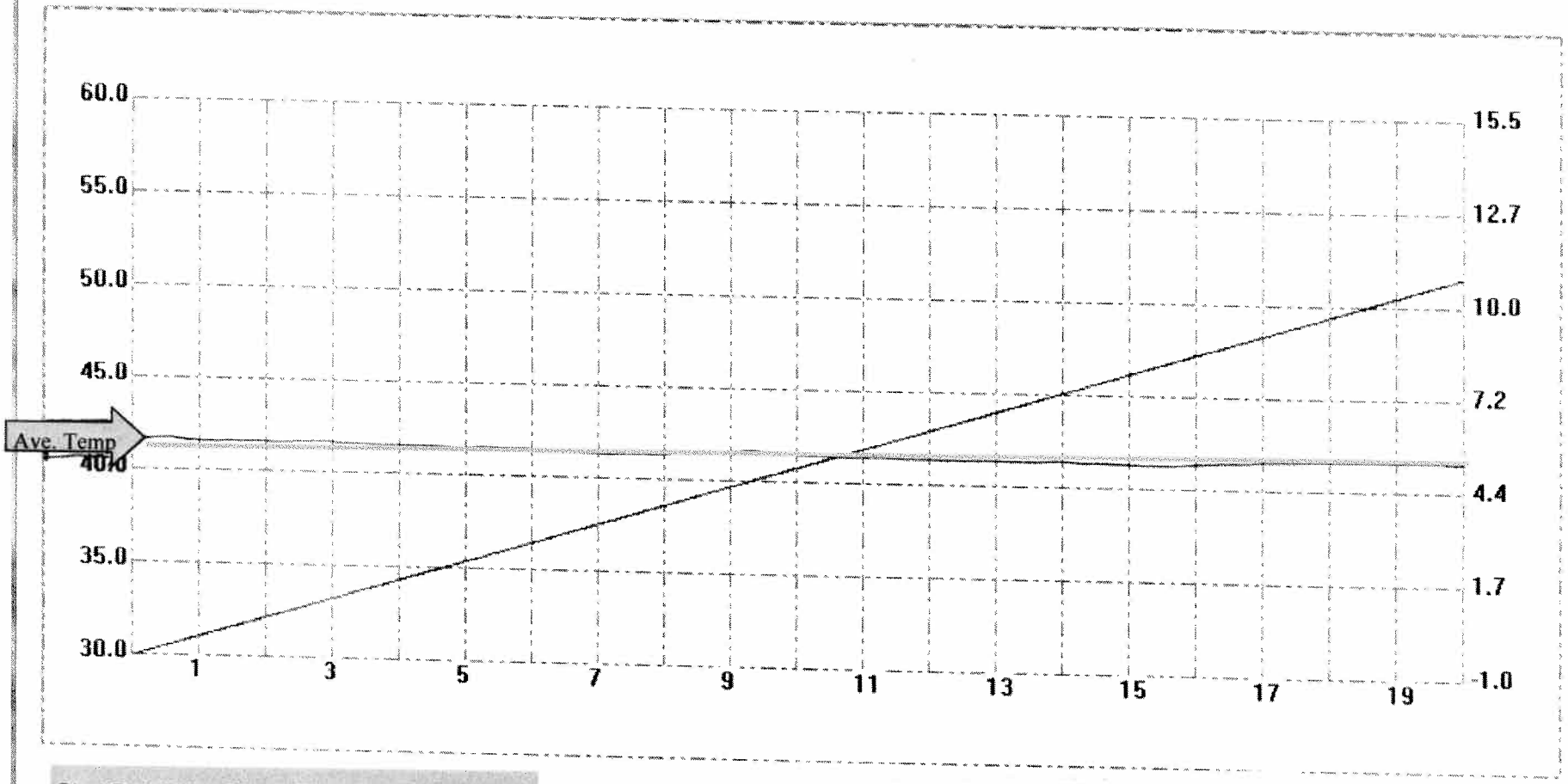
DataLogger

Save | Print | Clear | Exit

Battery Level

Low — Full

Data Report:



Start Date/Time Stamp/Time Zone:

UTC Offset (in hours)

Printed By:

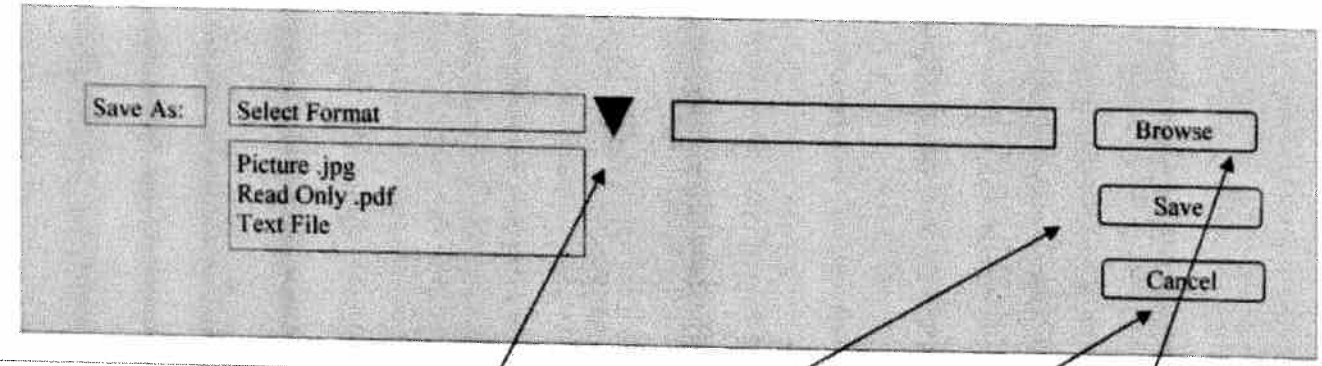
Shipper Notes

Logger Serial Number:

Date/Time:

SAVE

Press Save to open SAVE dialog box below



Arrow opens dropdown box allowing user to select one of three save options.

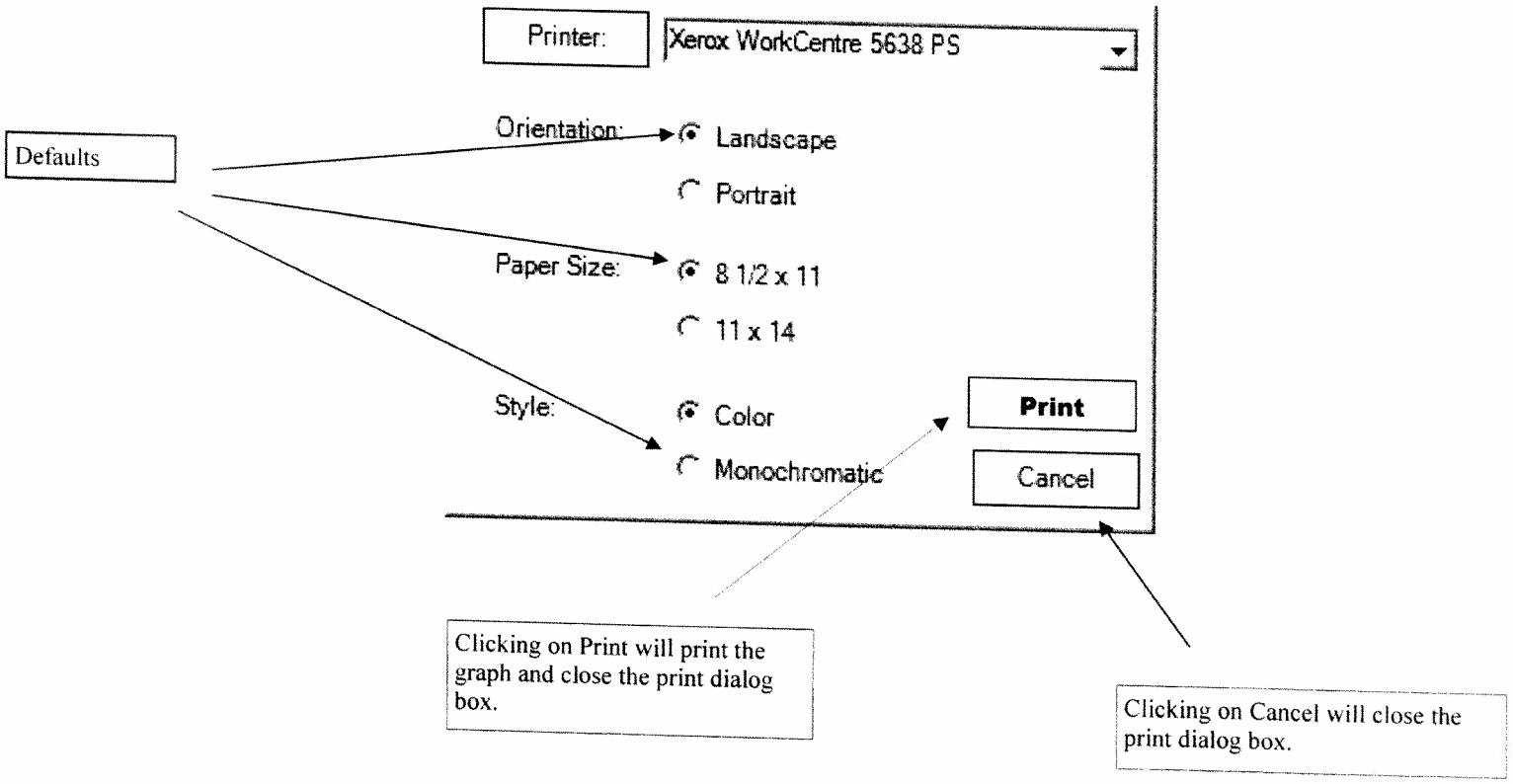
Pressing CANCEL will close the popup window without saving.

Pressing SAVE, after the format and location have been selected will save the graph and close the popup window.

Browse allows the user to select the Save To location

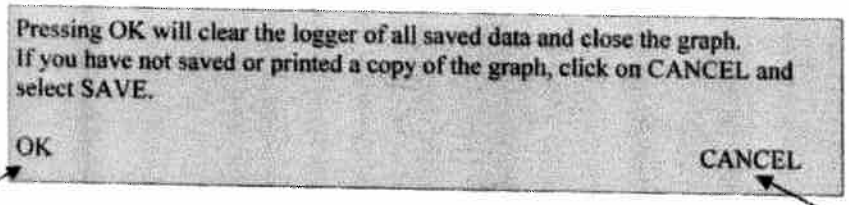
Print

Selecting Print will open the PRINT dialog box below. Should behave something like the following:



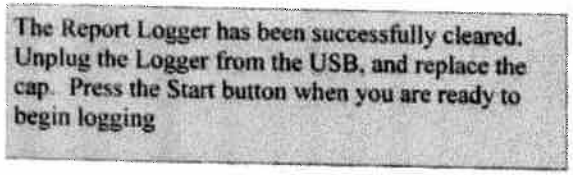
CLEAR LOGGER

Pressing CLEAR LOGGER opens a popup window below—User must click OK to clear



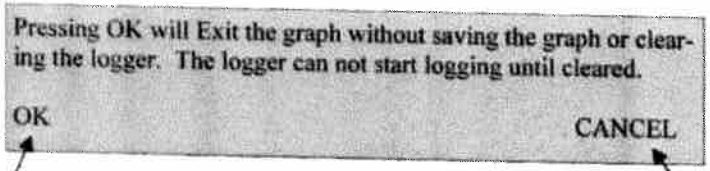
Clicking on OK will do the following:

1) Test logger voltage—issue popup if it is too low (see next page) Will not move to step 2 till pop up is cleared. If voltage is OK, no pop up move to step 2.
2) Clear the logger
3) Reset and write new Start Time, Date, UCT Offset
4) Prepare the logger to be removed from the PC
5) Close the graph window
6) Open the following window:



Clicking on CANCEL will close the clear logger window. The graph will continue to display..

Pressing EXIT opens a popup window below—User must click OK to exit



Pressing OK will:

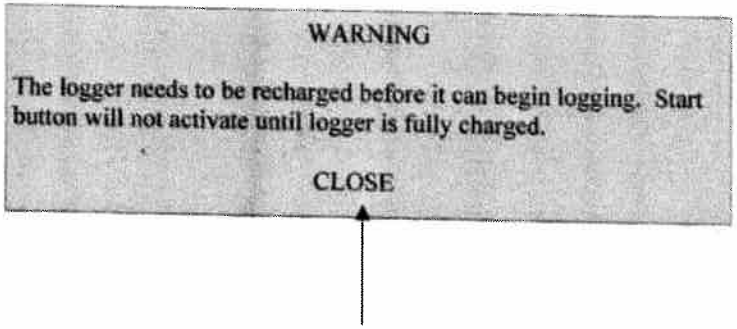
1) Close the pop up window
2) Close the Graph window
3) Prepare the logger to be removed from the PC
4) Open Popup:

Pressing Cancel will:

Close pop up window

Low Power pop up

When the user elects to CLEAR LOGGER the program will check the voltage level of the logger and then calculate if the voltage level is enough for the logger to log continuously for the entire logging period. NOTE: The Variables required to determine the required voltage level include: Current Voltage, Current Temp, Target Temp (-40F), Logging Time, Sample Rate If the voltage level is below the minimum required to allow the logger to continuously log for the entire factory set logger time, then the following message will pop up.

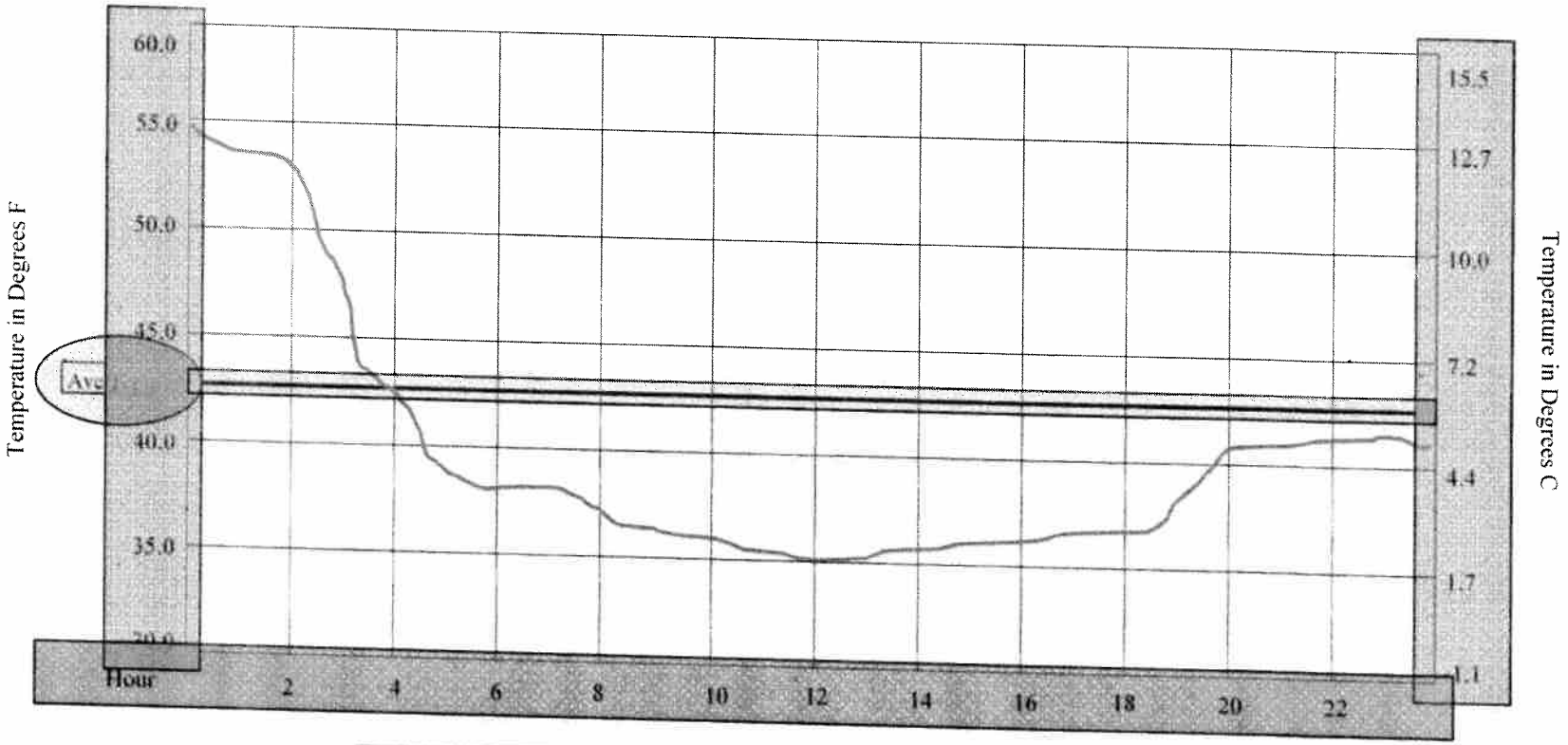


Pressing CLOSE will:

Close the WARNING pop up and continue on with Clear Logger process.

SAVE | Print | CLEAR LOGGER | EXIT | Battery Level (Low — Full)

Data Report: _____



Start Date/Time Stamp: November 1, 2010, 21:22.37, Pacific Time

Logger Serial Number: 09003124

UCT Offset (in hours) 6

Printed By: _____

Date/Time: _____

Shipper Notes _____

_____

SAVE	Clicking on Save opens Save Dialog Box.
Print	Clicking on Print opens Print Dialog Box
CLEAR LOGGER	Clicking on Clear Logger opens a popup window confirming with the user that all data will be cleared from the logger.
EXIT	Clicking on Cancel will open a popup window confirming that the logger has not been cleared and can not start logging until it has been cleared.
Battery Level 	Plots logger voltage
	Average temp indicator will draw a straight line across the graph and post the Ave. Temp. indicator arrow on the left Y axis to indicate average temperature.
Left and Right Y Axis	Left and Right Y axis: Right = deg. F / Left = deg. C, Y axis will display degrees to the 10th decimal position., Y should
Start Date/Time Stamp:	Populated by time and date written to logger when it was last cleared.
Logger Serial Number:	Logger Serial Number is assigned at the factory and can not be changed by the user.
	All remaining fields are filled in by the user via the graphing object—none of this information is saved once the user saves or prints a copy of the graph.
X Axis	X Axis title and markers are different for each recording time. See X axis definitions for each recording time on following page.

X Axis

X Axis title and markers are different for each recording time.

1 Day	Hour
3 Day	Hour

2 4 6 8 10 12 14 16 18 20 22

6 12 18 24 30 36 42 48 54 60 66

7 Day	Day

1 2 3 4 5 6

10 Day	Day

1 2 3 4 5 6 7 8 9

20 Day	Day

1 3 5 7 9 11 13 15 17 19

40 Day	Day

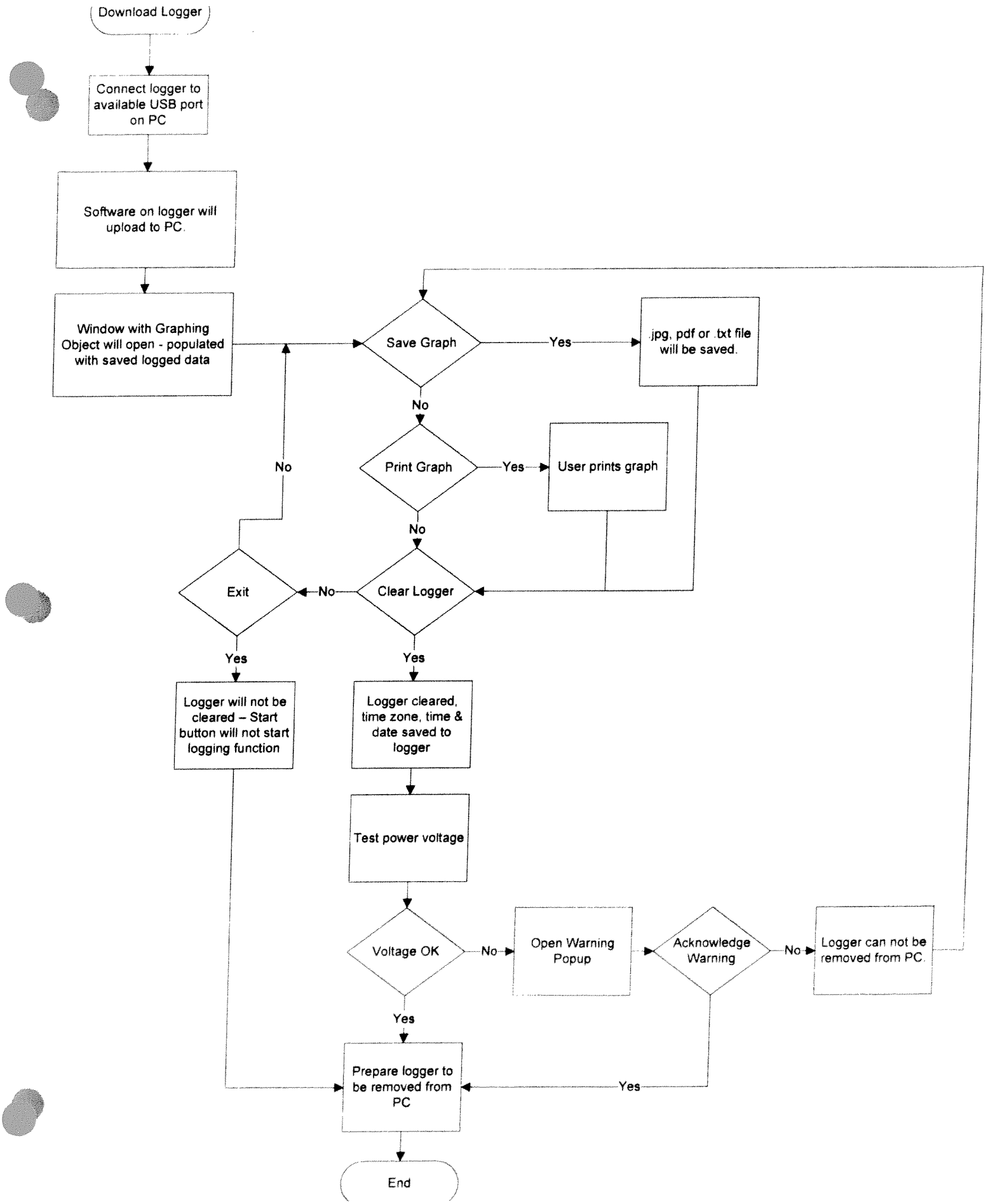
2 6 10 14 18 22 26 30 34 38

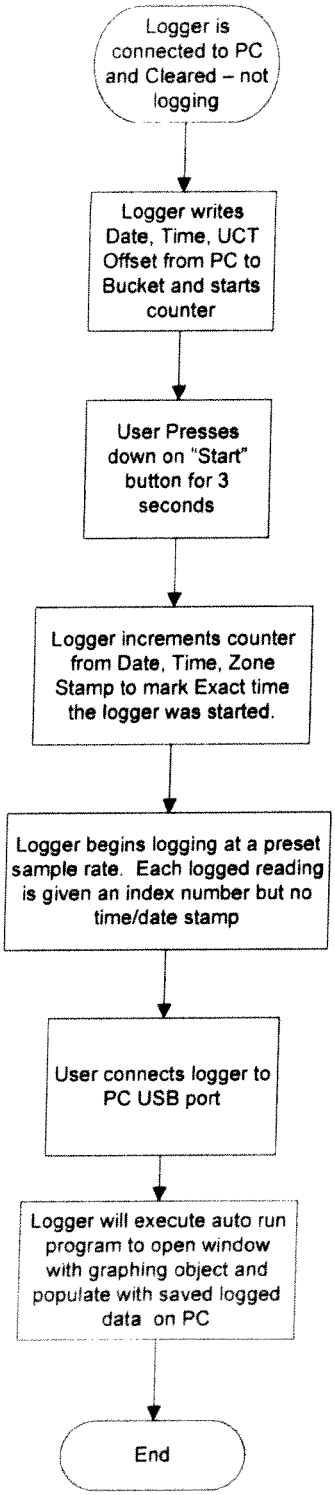
75 Day	Day

5 15 25 35 45 55 65

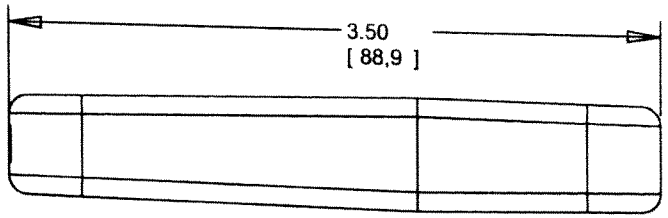
90 Day	Day

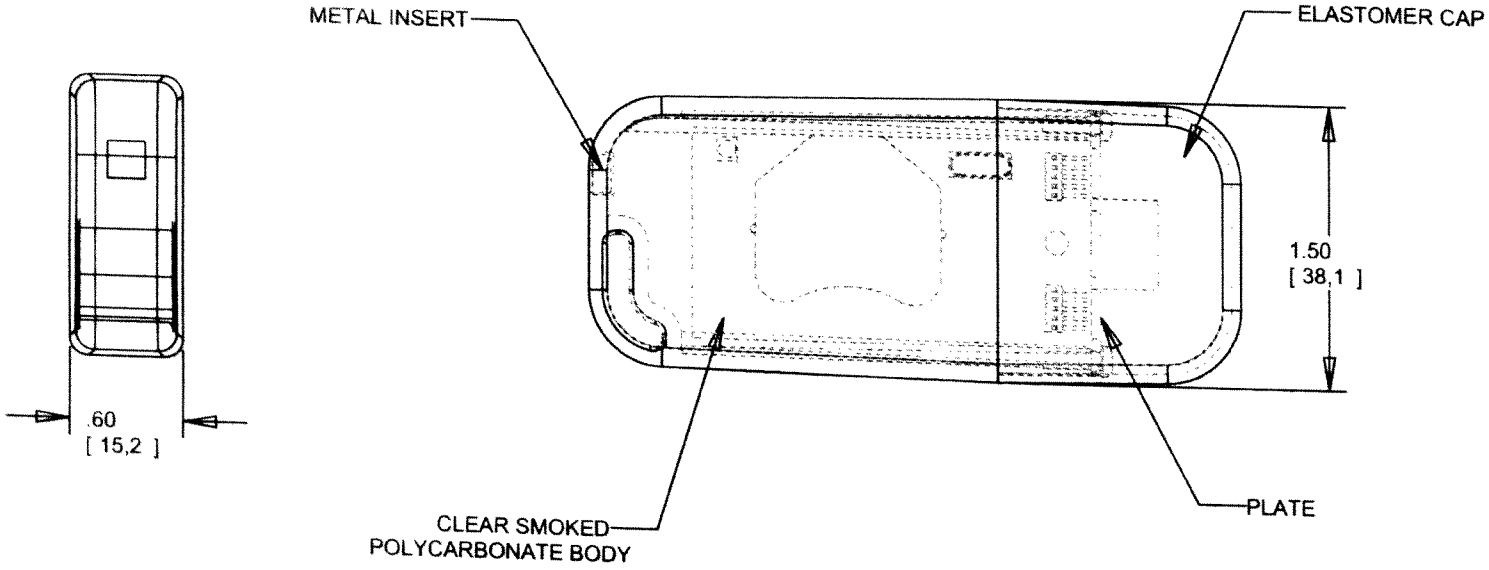
10 20 30 40 50 60 70 80


Download Logger
Connect logger to available USB port on PC
Software on logger will upload to PC.
Window with Graphing Object will open - populated with saved logged data
Save Graph
Yes
jpg, pdf or .txt file will be saved.
No
Print Graph
Yes
User prints graph
No
No
Exit
No
Clear Logger
Yes
Yes
Logger will not be cleared – Start button will not start logging function
Logger cleared, time zone, time & date saved to logger
Test power voltage
Voltage OK
No
Open Warning Popup
Acknowledge Warning
No
Logger can not be removed from PC.
Yes
Prepare logger to be removed from PC
Yes
End


Logger is connected to PC and Cleared – not logging
Logger writes Date, Time, UCT Offset from PC to Bucket and starts counter
User Presses down on "Start" button for 3 seconds
Logger increments counter from Date, Time, Zone Stamp to mark Exact time the logger was started.
Logger begins logging at a preset sample rate. Each logged reading is given an index number but no time/date stamp
User connects logger to PC USB port
Logger will execute auto run program to open window with graphing object and populate with saved logged data on PC
End

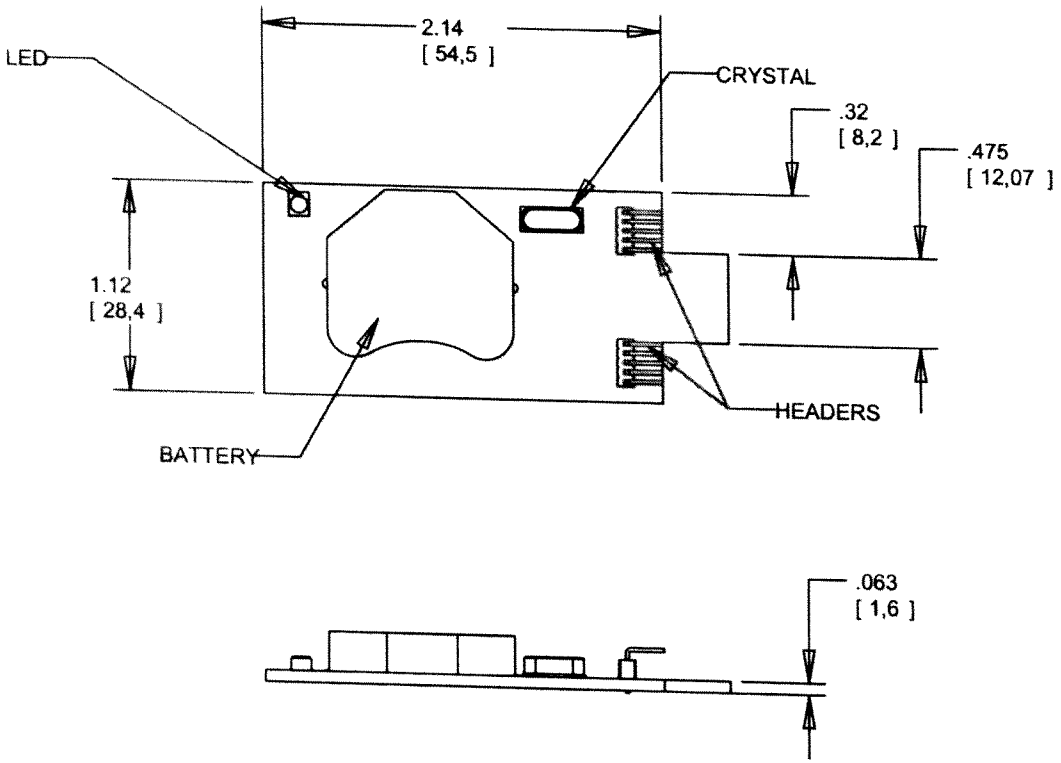
PRELIMINARY





Rev	ECN NO.	Description	DATE	DO NOT SCALE DRAWING		DICKSON	
		CONCEPT		UNIT OF MEASURE	TOLERANCE UNLESS SPECIFIED	930 S. WESTWOOD AVE. ADDISON IL. 60101	
				X INCHES	XX = ±.01" XXX = ±.005"	DRAWING TITLE REPORT LOGGER ASSEMBLY	
				METRIC	.x = 0.13mm	SHEET 1 OF 1	SIZE A SCALE: 1:1
				FRACTIONS ± 1/64" ANGLES ± 1/2 °		DRAWN DAA	CHECKED APPROVED DATE 01/19/10
				NEXT ASSEMBLY	QTY 1	MATERIAL ---- FINISH ----	DRAWING NO. REV

PRELIMINARY



Rev	ECN NO	Description	DATE
		CONCEPT	

DO NOT SCALE DRAWING

UNIT OF MEASURE	TOLERANCE UNLESS SPECIFIED
X INCHES	.XX = ±.01" .XXX = ±.005"
METRIC	* 0.13mm

FRACTIONS ± 1/64"
ANGLES ° 1/2 °

NEXT ASSEMBLY | QTY. 1

DICKSON
930 S. WESTWOOD AVE.
ADDISON IL. 60101

DRAWING TITLE: REPORT LOGGER CIRCUIT BOARD

SHEET 1 OF 1	SIZE A	SCALE: 1:1	
DRAWN DAA	CHECKED	APPROVED	DATE 01/19/10

MATERIAL —— | DRAWING NO. | REV
FINISH ——

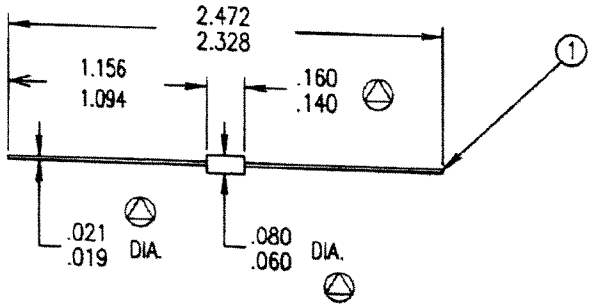
REV
DRAWING NO

Product	Specification	Spec Detail
RL100	Additonal Component Specifications	Software: Auto Run, Open Graphing Object and automatically populates with logged data saved to logger. User Options: Save Graph, Clear Logger, Exit
RL100	Ambient Operating Conditions Unit	-40 to 176F (-40 to 80C); 0 to 100% RH
RL100	Approvals (CE, UL, ROHS, IP)	CE, ROHS, IP64
RL100	Battery Life	Should be able to last 90 days at a 9 minute sample rate at 55 degrees F operating termperature with a visible LED flash every 10 seconds.
RL100	Battery Type	TBD either User Replaceable or Supper Cap - See Design Specifications for details.
RL100	Calibration In House	Zero, Span, Autocal
RL100	Calibration User	None
RL100	Defualt Settings	1 Day; 1 Minute Sample Rate, Stop When Full, deg F, Push to Start
RL100	Download Computer Interface	USB - Mass Storage Device - Windows Auto Play opens onboard Executable file
RL100	Download Time	1 Minute ? Will depend on the time required to open and populate graphing object
RL100	Enclosure Color	Translucent?
RL100	Enclosure Dimensions	Approximately: 3.25" x 1.5" x .5" (82.55 x 25.4 x 12.7mm)
RL100	Enclosure Type	See Drawings
RL100	Features	Compact, No DicksonWare Required, Generates Graph Data Summary, Connection to PC to clear logger is required to start logging.
RL100	Included with Instrument	Manual, Certificate of Calibration, (battery if used)
RL100	Indicators	LED (Red/Green) Dial Light 597-7701-2xx (See Attached Spec Sheet)
RL100	Keypad Functions	Push to Start Button just below USB jack; Recessed button on pcb to select Recording Time
RL100	Labels	Front: Label with Push to Start/Stop Button; Recessed Button, Back: Yellow Cal Label & Serial Label
RL100	Logger Resolution	0.1F
RL100	Memory Type	EEPROM
RL100	Mounting	Mounting hoop (hole in case)
RL100	Recording Time	Fixed sample interval (model dependent) for up to 90 Days of logging

Product	Specification	Spec Detail
RL100	Response Time	1 min to 63% FS typical
RL100	Sample Interval	Model Dependent
RL100	Sample Storage	> or = to 15,428 + system block
RL100	Software: PC Requirements	MS Windows XP and up; 1 free USB root hub
RL100	Storage Conditions	-40 to 176F (-40 to 70C); 0 to 95% RH
RL100	Temperature Accuracy Internal	±1.8F (±1C) Entire Range
RL100	Temperature Range Internal	-40 to 176F (-40 to 70C)
RL100	Temperature Sensor Internal	Thermistor
RL100	Unit Weight	Approximately 35g
RL100	Units of Measure	F/C
RL100	Warm Up Time	less than 15 seconds

SUFFIX	DESCRIPTION	STYLE NO.
G	GOLD	
T	TIN	466497
GTR	GOLD / TAPE & REEL	
TTR	TIN / TAPE & REEL	

1H50372		
REV	BY-DATE	ECN-NO
1	JW 6-29-04	84376
ADD STYLE NO.#466497		



BETA: (25/75) 3910 - 4020 K

18015 ± 2%	17655 - 18375	50
50K ± 2%	49000 - 51000	25
126980 ± 2%	124440 - 129519	5
RES OHMS ⊛	RES RANGE	TEMP°C

PROPRIETARY OF Therm-O-Disc, Emerson Electric

TITLE	H-UNIT THERMISTOR	ITEM NO. 1	QUANTITY 1	PART NAME H-UNIT	MATERIAL PART NUMBER P1H503	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES
CUSTOMER	DIXSON CO.	DRAWN BY JIMCEN WU	DATE 6-29-04	CHECKED BY Li Tong Tsue	DATE 6/29.04	MATERIALS
		CBP NO	MFG. REF.	STYLE NO. 466497		1H50372

Standard NTC Thermistor Characteristics

°C	°F	GRADE 1 Multiplier	GRADE 1 Alpha	GRADE 2 Multiplier	GRADE 2 Alpha	GRADE 3 Multiplier	GRADE 3 Alpha	GRADE 4 Multiplier	GRADE 4 Alpha
-40	-40	33.600	-6.6%	21.7000	-5.9%	14.4000	-5.0%	45.5	-7.2%
-35	-31	24.270	-6.4%	16.3042	-5.7%	11.2830	-4.9%	32.5	-7.1%
-30	-22	17.700	-6.1%	12.3688	-5.5%	8.90497	-4.8%	23.0	-7.0%
-25	-13	13.040	-5.9%	9.46998	-5.4%	7.07755	-4.8%	16.7	-6.7%
-20	-4	9.7060	-5.8%	7.31432	-5.3%	5.66345	-4.7%	12.1	-6.4%
-15	5	7.2940	-5.6%	5.69676	-5.2%	4.56177	-4.5%	8.90	-6.3%
-10	14	5.5319	-5.4%	4.47247	-4.8%	3.69786	-4.3%	6.60	-6.2%
-5	23	4.2324	-5.3%	3.53814	-4.7%	3.01609	-4.2%	4.90	-6.0%
0	32	3.2654	-5.2%	2.81947	-4.6%	2.47474	-3.9%	3.716	-5.9%
5	41	2.5396	-5.1%	2.26248	-4.5%	2.04231	-3.8%	2.8160	-5.6%
10	50	1.9903	-4.8%	1.82766	-4.3%	1.69490	-3.6%	2.1500	-5.5%
15	59	1.5714	-4.7%	1.48587	-4.2%	1.41421	-3.6%	1.6550	-5.3%
20	68	1.2493	-4.5%	1.21540	-4.1%	1.18620	-3.5%	1.2820	-5.2%
25	77	1.0000	-4.4%	1.00000	-4.0%	1.00000	-3.5%	1.0000	-5.0%
30	86	0.8056	-4.3%	0.827413	-3.9%	0.860	-3.2%	0.7853	-4.9%
35	95	0.6530	-4.2%	0.688312	-3.7%	0.729	-3.2%	0.6207	-4.8%
40	104	0.5327	-4.0%	0.575566	-3.6%	0.628	-3.1%	0.4935	-4.6%
45	113	0.4370	-3.9%	0.483685	-3.5%	0.536	-3.1%	0.3947	-4.5%
50	122	0.3603	-3.8%	0.408417	-3.4%	0.460	-3.0%	0.3175	-4.4%
55	131	0.2986	-3.6%	0.346447	-3.3%	0.400	-2.8%	0.2568	-4.2%
60	140	0.2488	-3.6%	0.295179	-3.2%	0.347	-2.8%	0.2088	-4.1%
65	149	0.2083	-3.5%	0.252567	-3.1%	0.302	-2.7%	0.1707	-4.0%
70	158	0.1752	-3.4%	0.216991	-3.1%	0.264	-2.6%	0.1402	-4.0%
75	167	0.1480	-3.3%	0.187161	-3.0%	0.234	-2.4%	0.1157	-3.9%
80	176	0.1255	-3.3%	0.162045	-2.9%	0.209	-2.3%	0.0959	-3.8%
85	185	0.1070	-3.3%	0.140811	-2.8%	0.186	-2.3%	0.0799	-3.7%
90	194	0.09150	-3.2%	0.122792	-2.8%	0.167	-2.2%	0.0668	-3.6%
95	203	0.07870	-3.1%	0.107442	-2.7%	0.150	-2.2%	0.0561	-3.5%
100	212	0.06800	-3.0%	0.0943195	-2.6%	0.134	-2.2%	0.0473	-3.4%
105	221	0.05920	-2.9%	0.0830615	-2.6%	0.120	-2.1%	0.0400	-3.3%
110	230	0.05170	-2.8%	0.0733706	-2.5%	0.109	-2.1%	0.0340	-3.2%
115	239	0.04500	-2.7%	0.0650015	-2.5%	0.0970	-2.1%	0.0290	-3.1%
120	248	0.03900	-2.6%	0.0577511	-2.4%	0.0882	-2.1%	0.0249	-3.1%
125	257	0.03400	-2.6%	0.0514507	-2.4%	0.0789	-2.0%	0.0214	-3.0%
130	266	0.03000	-2.5%	0.0459596	-2.3%	0.0722	-2.0%	0.0184	-3.0%
135	275	0.02650	-2.4%	0.0411602	-2.2%	0.0648	-2.0%	0.0159	-2.9%
140	284	0.02350	-2.4%	0.0369537	-2.1%	0.0590	-1.9%	0.0138	-2.9%
145	293	0.02090	-2.3%	0.0332571	-2.1%	0.0538	-1.9%	0.0120	-2.8%
150	302	0.01850	-2.3%	0.0300000	-2.0%	0.0490	-1.9%	0.0105	-2.7%
155	311	0.01620	-2.3%	0.0271230	-2.0%	0.0443	-1.9%	0.00918	-2.7%
160	320	0.01450	-2.2%	0.0245755	-1.9%	0.0406	-1.8%	0.00806	-2.6%
165	329	0.01300	-2.2%	0.0223144	-1.9%	0.0369	-1.7%	0.00709	-2.6%
170	338	0.01180	-2.2%	0.0203030	-1.8%	0.0342	-1.6%	0.00626	-2.5%
175	347	0.01070	-2.2%	0.0185096	-1.8%	0.0315	-1.6%	0.00553	-2.4%
180	356	0.00970	-2.1%	0.0169072	-1.7%	0.0291	-1.6%	0.00491	-2.4%
185	365	0.00870	-2.0%	0.0154724	-1.7%	0.0267	-1.5%	0.00436	-2.3%
190	374	0.00790	-2.0%	0.0141851	-1.7%	0.0250	-1.5%	0.00388	-2.3%
195	383	0.00720	-1.9%	0.0130277	-1.6%	0.0230	-1.5%	0.00346	-2.2%
200	392	0.00650	-1.9%	0.0119853	-1.6%	0.0215	-1.5%	0.00310	-2.2%
205	401	0.005980	-1.9%	0.0110446	-1.6%	0.0198	-1.4%	0.00278	-2.2%
210	410	0.005462	-1.8%	0.0101941	-1.5%	0.0187	-1.3%	0.00250	-2.1%
215	419	0.004997	-1.8%	0.00942390	-1.5%	0.0173	-1.3%	0.00225	-2.1%
220	428	0.004580	-1.8%	0.00872512	-1.5%	0.0165	-1.2%	0.00203	-2.1%
225	437	0.004205	-1.8%	0.00809011	-1.5%	0.0153	-1.2%	0.00184	-2.0%
230	446	0.003867	-1.7%	0.00751210	-1.5%	0.0146	-1.2%	0.00166	-1.9%
235	455	0.003561	-1.7%	0.00698515	-1.5%	0.0136	-1.2%	0.00151	-1.9%
240	464	0.003285	-1.6%	0.00650399	-1.5%	0.0130	-1.2%	0.00137	-1.9%
245	473	0.003035	-1.6%	0.00606399	-1.4%	0.0121	-1.2%	0.00125	-1.8%
250	482	0.002808	-1.5%	0.00566104	-1.4%	0.0115	-1.1%	0.00114	-1.8%

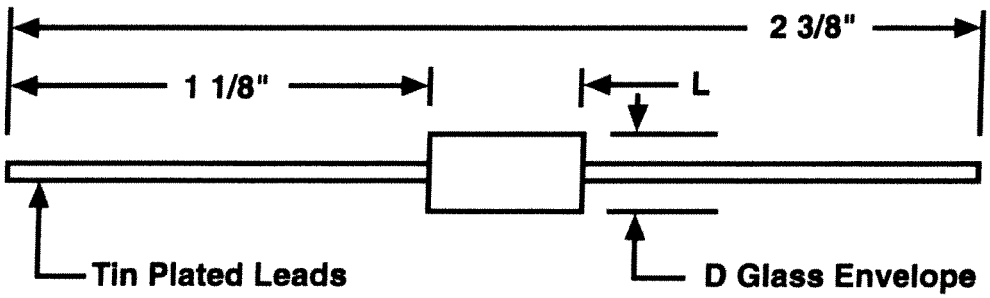
For applications above 150°C, consult with a Therm-O-Disc Sales Engineer.

H-Unit NTC Thermistors
Specifications & Catalog Numbers

TYPICAL CHARACTERISTICS* **		CATALOG NUMBER				
SPECIFICATION	TEST CONDITION	1H	PIH	UH	2H	4H
Resistance @ 25°C (OHMS)	Zero Power	3K-100K	3K-100K	3K-100K	1K-20K	200K-2M
Resistance Ratio	$R_{25°C}$ / $R_{125°C}$	29.41	29.41	29.41	19.44	46.73
Interchangeability°C	0°C-100°C	N/A	1°C	.2°C	N/A	N/A
Stability (change in resistance)	1000 hours @ 100°C	<.1%	<.1%	<.1%	N/A	N/A
Maximum Operating Temperature (°C)		300	300	300	300	300

* Dissipation Constant — Free Air; 1H (3K--9K)—5mw/°C; 1H(10K-100K)2H-4H—2mw/°C

**Time Constant — Stirred Oil; 1H (3K-9K)—1.5 sec. max; 1H(10K-100K)—2H-4H—1 sec. max.

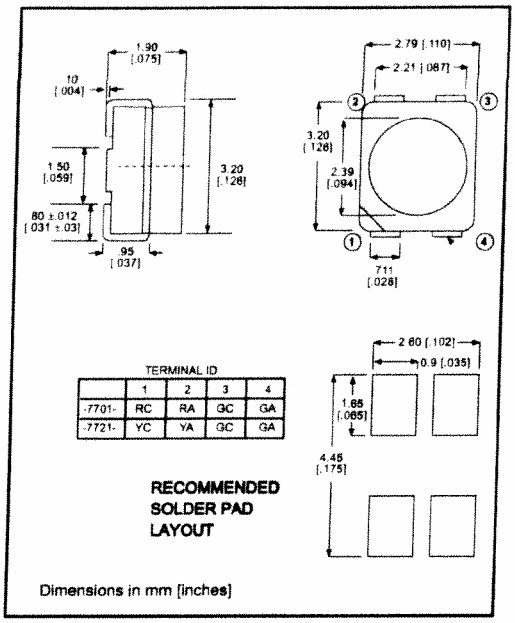

2 3/8"
1 1/8"
L
Tin Plated Leads
D Glass Envelope

microLED® Surface Mount LED Bi-Color

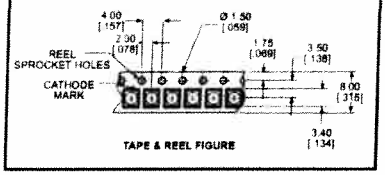
Dialight

597-7701-2xx
597-7721-2xx

1



TAPING SPECIFICATIONS
(rear side of tape)



PART NO.*	COLOR
597-7701-2xx	Red/Green
597-7721-2xx	Yellow/Green

Features

- Compatible with automatic placement equipment
- Compatible with infrared reflow processes
- Packaged on 8mm tape, 7" reels (meets EIA-481-1 standard)
- Helps to eliminate mixed technology PC board processing
- Compatible with Dialight's Optopipe™ Series light pipes

***ORDERING INFORMATION**

597-77x1-2xx

packaging option

02	20 pieces on tape
07	7" reel, 1500 pcs/reel

ABSOLUTE MAXIMUM RATINGS (T_A=25°C)	Red/Green **-7701**	Yellow/Green **-7721**
Power Dissipation (mW)	100/100	60/100
Forward Current (mA) Derating (mA/°C) *From 50°C*	30/30 .6/.6	20/30 .4/.6
Peak Current (mA) *Pulse width 10 µs*	120/120	80/100
Operating Temperature (°C)	-55/+100	-55/+100
Storage Temperature (°C)	-55/+100	-55/+100
Soldering Profile	235°C peak 15 seconds, 185° for 90 seconds	

Solder Adherence per MIL-STD-202E, Method 208C

OPERATING CHARACTERISTICS (T_A=25°C)		Red/Green **-7701**	Yellow/Green **-7721**
Luminous Intensity (mcd) I_F=20mA	Min. Typical	8/8 16/16	8/8 16/16
Peak Wavelength (nm) λ Peak	Typical	630/565	585/565
Viewing Angle ($2\Theta_{1/2}$)	Typical	120°	120°
Forward Voltage (V) I_F=20mA	Typical Max.	2/2.1 2.6/2.6	1.8/2.1 2.7/2.6

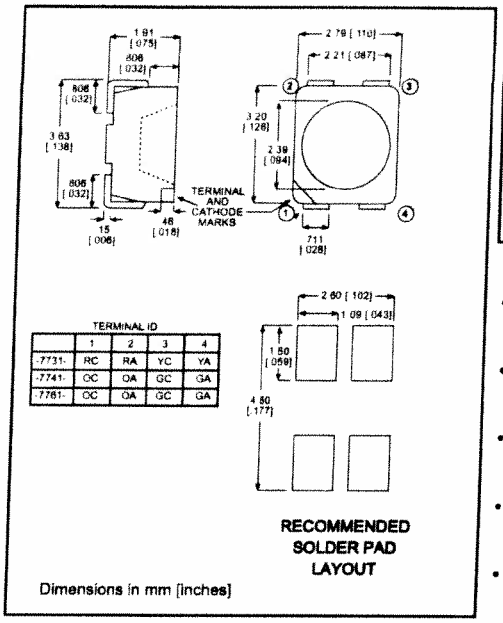
$\Theta_{1/2}$ is the off axis angle at which the luminous intensity is half the axial luminous intensity

microLED®

Surface Mount LED
Bi-Color

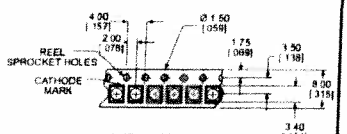
Dialight

597-7731-2xx
597-7741-2xx
597-7761-2xx



TERMINAL ID	1	2	3	4
-7731-	RC	RA	YC	YA
-7741-	OC	OA	GC	GA
-7761-	OC	OA	GC	GA

TAPING SPECIFICATIONS
(rear side of tape)



PART NO.*	COLOR
597-7731-2xx	Red/Yellow
597-7741-2xx	Orange/Green NEW
597-7761-2xx	Orange/ Pure Green NEW

Features

- Compatible with automatic placement equipment
- Compatible with infrared reflow processes
- Packaged on 8mm tape, 7" reels (meets EIA-RS-481-1 standard)
- Helps to eliminate mixed technology PC board processing
- Compatible with Dialight's Optopipe™ Series light pipes

***ORDERING INFORMATION**

597-77x1-2xx

packaging option

02	20 pieces on tape
07	7" reel, 2000 pcs/reel

ABSOLUTE MAXIMUM RATINGS (T_A=25°C)	Red/Yellow **-7731**	Orange/Green **-7741**	Orange/Pure Green **-7761**
Power Dissipation (mW)	100/100	100/100	100/100
Forward Current (mA)	30/30	30/30	30/30
Derating (mA/°C) *From 55°C*	.66/.66	.66/.66	.66/.66
Peak Current (mA) *Pulse width 10 µs*	500	500	500
Operating Temperature (°C)	-55/+100	-55/+100	-55/+100
Storage Temperature (°C)	-55/+100	-55/+100	-55/+100
Soldering Profile	235°C peak 15 seconds, 185° for 90 seconds		

Solder Adherence per MIL-STD-202E, Method 208C

OPERATING CHARACTERISTICS (T_A=25°C)		Red/Yellow **-7731**	Orange/Green **-7741**	Orange/Pure Green **-7761**
Luminous Intensity (mcd)	Min.	2.5/2.5	4/4	2.5/2.5
I_F=10mA	Typical	7.3/6.8	8/8	5/5
Peak Wavelength (nm) λ Peak	Typical	635/586	610/565	610/557
Viewing Angle (2Θ ½)	Typical	120°	120°	120°
Forward Voltage (V)	Typical	2/2	2/2	2/2
I_F=10mA	Max.	2.6/2.6	2.6/2.6	2.6/2.6
Reverse Voltage (V), I_R=10µA	Min.	5	5	5

Θ ½ is the off axis angle at which the luminous intensity is half the axial luminous intensity