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The LI-6200
Condensed Reference

Software Revision 2.00

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TABLE OF CONTENTS

Files 5
Exec Lists 6
Preoperation 7
Reminders 8
User Format Codes 9
0x Channels 10
1x Channels 11
2x Channels 12
3x Channels 13
Ax Constants 14
Bx Constants 15
Cx Constants 16
6x Programs 17
7x Programs 19
Conversions 21
Troubleshooting 22
Notes 24

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FILES

#	TYPE	FCT:	
1	**PAGE**	**E7**	Data and page parameters
2	**SYSTM**	**E3**	1x, 2x, 3x, Bx
3	**I/O**	**51**	I/O parameters
4	**ASCII**	**56**	General purpose
5	**PPARM**	**41**	Page parameters
6	**OPARM**	**42**	Operating parameters
7	**CO2**	**45**	CO_2 calibration list
8	**FLOW**	**46**	Flow calibration list
9	**RH**	**47**	Cal list
10	**SENSR**	**E2**	0x, Cx
11	**SFORM**	**D8**	System format
12	**UFORM**	**D9**	User format
13	**KEYS**	**E1**	User key definitions
14	**KBUFF**	**ED**	Key buffer
15	**VWSEQ**	**EC**	Miniview sequence
16	**PROG**	**E8**	Log key program

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EXEC LISTS

40	****SETUP****	**50**	****COMM****
41	**set pg parms**	**51**	**set I/O parms**
42	**set opr parm**	**52**	**terminal**
43	**set clock**	**53**	**dump pages**
44	**set QNTM cal**	**54**	**binary dump**
45	**set CO2 cal**	**55**	**binary load**
46	**set FLOW cal**	**56**	**ascii capture**
47	**set RH cal**	**57**	**ascii dump**
48	**zero FLOW**	**58**	**binary index**
49	**CO2 ref**	**59**	
4A	**leaf area**	**5A**	
4B	**aux data**	**5B**	
4C		**5C**	
4D		**5D**	
4E		**5E**	
4F		**5F**	
D0	*****MEM*****	**E0**	****CONFIG****
D1	**delete fiels**	**E1**	**set keys**
D2	**renum files**	**E2**	**set sensors**
D3	**mem status**	**E3**	**set sys prog**
D4	**file status**	**E4**	**reset E2, E3**
D5	**file index**	**E5**	**recompute**
D6	**STORE PAD**	**E6**	**CLEAR PAD**
D7	**edit loop**	**E7**	**view**
D8	**set sys fmt**	**E8**	**program**
D9	**set user fmt**	**E9**	**log**
DA	**view labels**	**EA**	**sys reset**
DB		**EC**	**set mini view**
DC		**DE**	**set kbuff**
DD		**ED**	**set kbuff**
DE		**EE**	**EXEC KBUFF**
DF	**clear mem**	**EF**	**SWAP TERM**

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PREOPERATION

1. Work through the SETUP execute list (**SETUP**, or **FCT 40**), which covers the following:
   - Page parameters
   - Operating parameters
   - Set the clock
   - Quantum sensor cal constant
   - CO_2 analyzer cal list
   - Flowmeter cal list
   - RH sensor cal list
   - Set analyzer reference

2. Check each sensor to make sure it is responding as expected:
   - Quantum sensor
   - Air and leaf temp matched?
   - IRGA temp
   - Flowmeter
   - CO_2 concentration
   - Relative humidity

3. Set the ZERO and SPAN for the CO_2 analyzer.

4. ZERO the flowmeter (**FCT 48**).

5. Check the humidity sensor against a standard you can trust.

6. Check system for leaks.

7. Desiccant test (K Test).

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REMINDERS

EVERY 10 -15 MINUTES...
- Shake the desiccant tube

EVERY 30 - 60 MINUTES...
- Zero the flowmeter
- Check the CO_2 analyzer zero
- Test the desiccant (K Test)

EVERY DAY...
- Preoperation procedure
- Clean chambers
- LI-6250 fan filter
- Re-charge used batteries

EVERY FEW WEEKS...
- Check soda lime
- LI-6250 filter #2

EVERY YEAR...
- LI-6250 filter #3
- LI-6250 internal soda/desiccant

OR

- Return to factory for complete recalibration

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USER FORMAT CODES

HDR	Entire header
PAG	Page number
DAY	Day (numeric)
MON	Month (numeric)
HOU	Hour
MIN	Minute
SEC	Second
TIM	Time in HH:MM:SS
DAT	Date in DD MMM
NOB	# observations
SYS	System number
APR.n	nth auxiliary data prompt
AXD.n	nth auxiliary data
EOL<.n>	End of line (or n EOLs)
SPA<.n>	Space (or n spaces)
Ax	Parameters (AA thru AF)
1x.n	nth sample of channel 1x
1x.nM	nth mean obs of channel 1x
1x.nR	nth range of obs of channel 1x
2x.n	nth obs of channel 2x
3x.n	nth obs of channel 3x
OB.n	nth observation #
LOOP...ENDLOOP	Use * for obs.

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0x CHANNELS

00	**LOW**	reserved
01	**LOW TA**	Chamber temp (mV)
02	**LOW TL**	Leaf temp (mV)
03	**LOW RH**	Relative humidity (mV)
04	**LOW TC**	IRGA temp (mV)
05	**HIGH C2**	CO_2 signal (mV)
06	**LOW QN**	Qntm (mV)
07	**LOW FL**	Flowmeter signal (mV)
08	**OFF**	Spare channel 1 (mV)
09	**OFF**	Spare channel 2 (mV)
0A	**OFF**	Spare channel 3 (mV)
0B	**OFF**	Spare channel 4 (mV)
0C	**OFF**	Spare channel 5 (mV)
0D	**OFF**	Spare channel 6 (mV)
0E LOW BA		Battery Voltage (V)
0F LOW		reserved

Accessed by **FCT E2**.

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1x CHANNELS

10	**TIME**	**70**						
11	**QNTM**	**06**	**C6**	**CC**	**64**	**65**		
12	**TAIR**	**01**	**C3**	**64**				
13	**TLEAF**	**02**	**C4**	**64**	**12**	**62**		
14	**TCO2**	**04**	**C3**	**64**				
15	**CO2**	**05**	**CB**	**64**	**CA**	**62**	**14**	**71**
16	**FLOW**	**07**	**C8**	**63**	**14**	**72**	**CF**	**64**
17	**RH**	**03**	**C7**	**64**	**73**			
18	**EAIR**	**12**	**74**	**C2**	**65**	**17**	**64**	
19	**DE/DT**	**6F**	**18**					
1A	**DC/DT**	**6F**	**15**					

1B - 1F Unused

Accessed by **FCT E3**.

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2x CHANNELS

20		Unused
21	**W**	**12 75 A1 64 6D 2F 18 A0 65**
22	**FRACT**	**16 A5 65**
23	**FW/S**	**16 21 64 A1 65 C2 65**
24	**K**	**A2 A6 22 64 63 19 64 2F 65 6D 25 66 23 64 67**
25	**E**	**25 A7 64 23 62 C1 21 63 65**
26	**GS**	**13 74 18 25 A0 A4 A3 76 79**
27	**DC**	**A2 A0 64 1A 64 2F 65 15 25 64 62**
28	**A**	**23 15 64 27 C1 21 22 64 63 64 63**

.
.

2F (RTS)

Accessed by **FCT E3**.

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3x CHANNELS

30	**PHOTO**	**B0**	**28**	**64**						
31	**COND**	**B1**	**26**	**64**						
32	**CINT**	**26**	**A4**	**A3**	**76**	**7A**	**25**	**15**	**28**	**7B**
33	**RS**	**12**	**75**	**A0**	**65**	**26**	**64**	**6D**	**34**	**66**	**B2**	**64**
34	**CS**	**34**	**B3**	**64**						
35 - 3F		Unused								

Accessed by **FCT E3**.

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Ax CONSTANTS

A0	**P(mb)**
A1	**A(cm2)**
A2	**Vt(cc)**
A3	**BC(mol)**
A4	**STMRAT**
A5	**Fx(µmol)**
A6	**Vg(cc)**
A7	**Kabs**
A8	**A8**
A9	**A9**
AA	**AUX DATA 1**
AB	**AUX DATA 2**
AC	**AUX DATA 3**
AD	**AUX DATA 4**
AE	**AUX DATA 5**
AF	**AUX DATA 6**

Ax constants are accessed by **FCT 41**, or by **FCT Ax**.

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Bx CONSTANTS

B0	**1.00**	Photo multiplier
B1	**1.00**	Cond multiplier
B2	**1.00**	RS multiplier
B3	**1.00**	CS multiplier
B4	**0.0**	Unused
B4	**0.0**	Unused
B5	**0.0**	Unused
B6	**0.0**	Unused
B7	**0.0**	Unused
B8	**0.0**	Unused
B9	**0.0**	Unused
BA	**0.0**	Unused
BB	**0.0**	Unused
BC	**0.0**	Unused
BD	**0.0**	Unused
BE	**0.0**	Unused
BF	**0.0**	Unused

Bx constants are accessed by **FCT E3**, or by **FCT Bx.**

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Cx CONSTANTS

C0	**0.0**	Unused
C1	**1.0**	Unused
C2	**100.0**	Unused
C3	**0.012207**	Thermistor
C4	**0.00226**	Thermocouple C1
C5	**0**	Unused
C6	**??**	Quantum cal
C7	**0.024414**	Humidity
C8	**??**	Flow zero
C9	**0**	CO_2 ppm
CA	**0**	CO_2 mV
CB	**1.00**	CO_2 gain factor
CC	**0.1790**	Quantum gain
CD	**0.0**	Unused
CE	**0.0**	Unused
CF	**44.64**	Flow

Cx constants are accessed by **FCT E2**, or by **FCT Cx**.

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6x STACK OPERATORS

60	$\leftrightarrows$	Swap top 2 entries
61	$\rightarrow$	Drop top entry off stack
62	+	Add top two entries
63	-	Subtract top two entries
64	$\times$	Multiply top two entries
65	$\div$	Divide top two entries
66	1/x	Invert top entry
67	-x	Change Sign of top entry
68	x^2	Square top entry
69	x^3	Cube top entry
6A	$\sqrt{x}$	Square Root of top
6B	$\leftarrow$	Duplicate top entry
6C		Fetch previous 1x, 0x value
6D		Store top entry to ___
6E		Fetch range obs of 1x
6F		Slope channel flag

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7x STACK OPERATORS

70 Time since pad cleared.
Initial Stack: ● ● (top)
Final Stack: ● time (s) ● (top)

71 CO_2 calibration function.
I: ● Signal (mV) ● Temp (C)●
F: ● CO2 (ppm) ●

72 Flow calibration function.
I: ● Signal (mV) ● Temp (C) ●
F: ● Std Flow (cm^3 s^{-1}) ●

73 RH Lookup Table.
I: ● Measured RH (%) ●
F: ● True RH (%) ●

74 Saturation Vapor Pressure
I: ● Temp (C) ●
F: ● Vapor pressure (mb) ●

75 8.314 × (T + 273)
I: ● T ●
F: ● 8.314 × (T + 273)

76 Boundary Layer Correction
I: ● Stmrat ● BC ●
F: ● Corrected BC ●

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7x STACK OPERATORS cont'd

77 CO_2 Reference
I: ● Ref (ppm) ● Temp (C) ● P (mb)●
F: ● Ref (ppm) ● Ref (mV) ● Gain Factor ●

78 CO_2 Slope
I: ● Signal (mV) ● Temp (C) ●
F: ● Cal Function Slope ●

79 Stomatal Conductance
I: ● SL ● ea ● E ● P ● BC ●
SL = Sat vap press of leaf (mb)
ea = Vap press of air (mb)
E = Transpiration (mol m^{-2} s^{-1})
P = Pressure (mb)
BC = Bound. layer cond (mol m^{-2} s^{-1})
F: ● Cond (mol m^{-2} s^{-1})●

7A Cond. to CO_2
I: ● g ● BC ●
g = Stom. cond. (mol m^{-2} s^{-1})
BC = Bound. layer cond (mol m^{-2} s^{-1})
F: ● Cond CO_2 (mol m^{-2} s^{-1})●

7B Intercellular CO_2
I: ● g ●E ● C ● A ●
g = Stom. cond. (mol m^{-2} s^{-1})
E = Transpiration (mol m^{-2} s^{-1})
C = Ambient CO_2 (ppm)
A = Assim. rate (µmol m^{-2} s^{-1})
F: ● C_i (ppm) ●

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7x STACK OPERATORS cont'd

7C Density Factor
I: ● Temp (C) ● P (mb) ●
F: ● $(TP_o)/(T_oP)$ ●

7D 5th Order Polynomial
I: ● a ● b ● c ● d ● e ● f ● x ●
F: ● $a+bx+cx^2+dx^3+ex^4+fx^5$ ●

7E DeltaT (Energy Balance)
I: ● BC ● Ta ● TW ● E ● Rn ●
BC = Bound. layer cond (mol m^{-2} s^{-1})
Ta = Chamber air temp (C)
TW = Chamber wall temp (C)
E = Transpiration (mol m^{-2} s^{-1})
Rn = Net radiation (W m^{-2})
F: ● $(T_{leaf} - T_{air})$ ●

7F Transpiration (Energy Balance)
I: ● BC ● Ta ● Tl ●T_W ●Rn ●
BC = Bound. layer cond (mol m^{-2} s^{-1})
Ta = Chamber air temp (C)
Tl = Leaf temp (C)
T_W = Chamber wall temp (C)
Rn = Net radiation (W m^{-2})
F: ● Transpiration (mol m^{-2} s^{-1}) ●

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CONVERSIONS

Photosynthesis
$\mu mol\ m^{-2}\ s^{-1} \times 0.044 = mg\ m^{-2}\ s^{-1}$
$\mu mol\ m^{-2}\ s^{-1} \times 1.584 = mg\ dm^{-2}\ hr^{-1}$
$mg\ m^{-2}\ s^{-1} \times 36 = mg\ dm^{-2}\ hr^{-1}$

Transpiration
$mol\ m^{-2}\ s^{-1} \times 18{,}000 = mg\ m^{-2}\ s^{-1}$
$mol\ m^{-2}\ s^{-1} \times 44{,}100 = W\ m^{-2}$

Conductance
$mol\ m^{-2}\ s^{-1} \times 2.5 = cm\ s^{-1}$

Pressure
mm Hg × 1.333 = millibar
kPa × 10 = millibar

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TROUBLESHOOTING

Conductance Too Low

- Humidity reading too low.
- Flowmeter reading too low. (Re-zero?)
- Leaf area too high.
- Volume too low (if not steady state conditions).
- Bad contact between leaf thermocouple and leaf, with $T_{leaf} < T_{air}$.
- Did humidity rise during the measurement? Use a higher flow rate if possible.

Conductance Too High or Negative

- Humidity reading too high.
- Flowmeter reading too high. (Re-zero?)
- Desiccant not adequate.
- Volume too high (if not steady state conditions).
- Leaf area too low. If it is low enough to make the leaf resistance come out smaller than the boundary layer resistance, then the stomatal resistance (and conductance) will be negative.
- Bad contact between leaf thermocouple and leaf, with $T_{leaf} > T_{air}$.
- Did humidity fall during the measurement? Use a lower flow rate.

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TROUBLESHOOTING, Cont'd

Photosynthesis Too Low (High)

- CO_2 analyzer calibrated correctly? Are you sure of your span gas?
- Volume too low (high).
- Leaf area too high (low).
- Pressure parameter too low (high).

Intercellular CO_2 Too Low (High)

- Photosynthesis too high (low).
- Stomatal conductance too low (high).

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NOTES

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