6000-count LoggerClamp™ Series Communication Protocol

***COM Port Communication Protocol:**
(Baud rate, Parity, Data bits, Stop bit) = (2400, N, 8, 1)
Command:
Real Time Download: ***Set RQS pin of COM port to 0 for 10ms***
Non-Volatile Memory Download: ***Set RQS pin of COM port to 0 for 1500ms***

A). Real Time Download
Request Real Time Data : Set RQS=0 for 10ms

Recommended program flow.
1. Initiate COM port
2. Wait for 100ms
3. Set RQS=1
4. Set (baud rate, parity, data bit, stop bit) = (2400, N, 8,1)
5. Locate 17 RXD buffers (No. 0 to No. 16)
6. Clear RXD buffers
7. Set RQS=0
8. Wait for 10ms
9. Set RQS=1
10. Check & read RXD buffers
11. Decode last 16 RXD buffers (see Figure 1 & Table 1)
12. Repeat 6~11 to get next reading

Figure 1

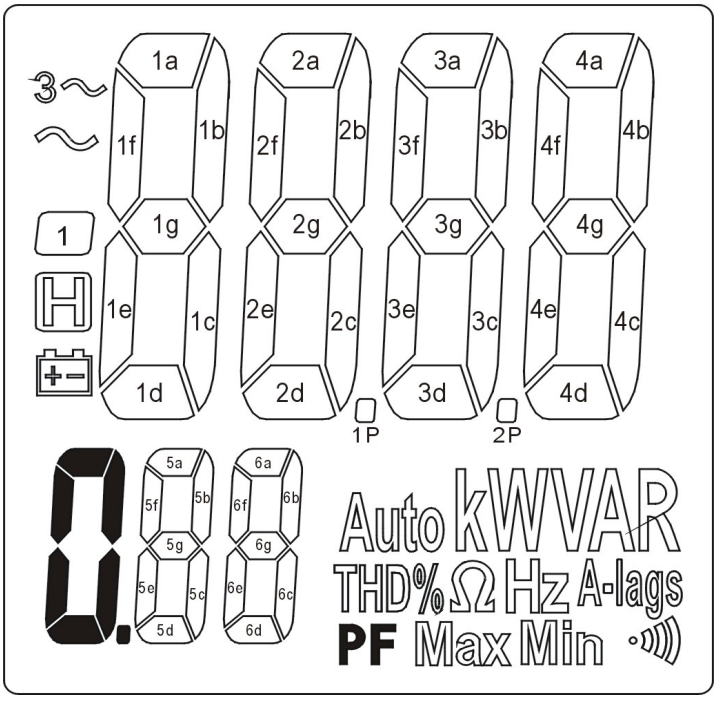
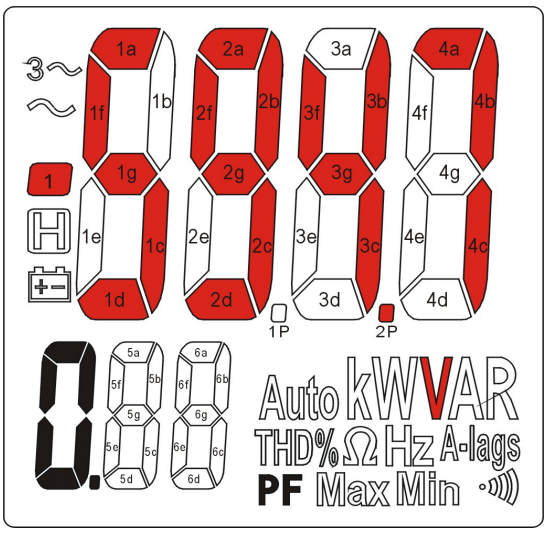


Table 1. LCD Map

No.	bit7:4	bit3	bit2	bit1	bit0
0	Don't care				
1	0000	1	1e	1f	1a
2	0001	+-	H	~	3~
3	0010	A-lags	2e	2f	2a
4	0011	1d	1c	1g	1b
5	0100	1p	3e	3f	3a
6	0101	2d	2c	2g	2b
7	0110	2p	4e	4f	4a
8	0111	3d	3c	3g	3b
9	1000	0 +PF	5e	5f	5a
10	1001	4d	4c	4g	4b
11	1010	%	6e	6f	6a
12	1011	5d	5c	5g	5b
13	1100	Max	Ω	k	Auto
14	1101	6d	6c	6g	6b
15	1110	THD	·))	R	A
16	1111	Min	Hz	V	W

Example: ***While LCD reading is " -594.7V", 17 data bytes are "??H, 0BH, 10H, 23H, 3EH, 42H, 5FH, 69H, 77H, 80H, 95H, A0H, B0H, C0H, D0H, E0H, F2H"***



NO.	bit7:4	bit3	bit2	bit1	bit0	HEX format
1	0000	1	0	1	1	0BH
2	0001	0	0	0	0	10H
3	0010	0	0	1	1	23H
4	0011	1	1	1	0	3EH
5	0100	0	0	1	0	42H
6	0101	1	1	1	1	5FH
7	0110	1	0	0	1	69H
8	0111	0	1	1	1	77H
9	1000	0	0	0	0	80H
10	1001	0	1	0	1	95H
11	1010	0	0	0	0	A0H
12	1011	0	0	0	0	B0H
13	1100	0	0	0	0	C0H
14	1101	0	0	0	0	D0H
15	1110	0	0	0	0	E0H
16	1111	0	0	1	0	F2H

B). Non-Volatile Memory Download

Request Non-Volatile Memory Data : Set RQS=0 for 1500ms

Recommended program flow.

1. Initiate COM port
2. Wait for 100ms
3. ***Set RQS=1***
4. Set (baud rate, parity, data bit, stop bit) = (2400, N, 8,1)
5. Locate 32710 RXD buffers (Starting from No. 0)
6. Clear RXD buffers
7. ***Set RQS=0***
8. ***Wait 1500ms***
9. ***Set RQS=1***
10. Check & read RXD buffers
11. Decode RXD buffers (see Table 2)

Table 2. Non-Volatile Memory Data Output Map

No.	Description	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
0		Don't Care								
1	*EndAddr0*	Address of Last Record Data (Low-Byte)								*1
2	*EndAddr1*	Address of Last Record Data (Hi-Byte)								
3		A0H								
4	*AbsMax_A0*	Address of Absolute Maximum Record Data (Low-byte)								*2
5	*AbsMax_A1*	Address of Absolute Maximum Record Data (Hi-byte)								
6		A0H								
7	*AbsMin_A0*	Address of Absolute Minimum Record Data (Low-byte)								*3
8	*AbsMin_A1*	Address of Absolute Minimum Record Data (Hi-byte)								
9		A0H								
10	*Model_Id*	*DMM Model ID -- 00H: BM131; 01H: BM132; 10H: BM135*								
11	*DLBFunc*	see Table 3								
12	*DLBSel*									
13	*DLMode*									
14 | 18		Null								
19	*1'st Hi_D_0B*	D1				D0				*4
20	*1'st Hi_D_1B*	D3				D2				
21	*1'st Hi_D_2B*	+/-	OL	Range		-	-	-	-	
22	*1'st Lo_D_0B*	D1				D0				
23	*1'st Lo_D_1B*	D3				D2				
24	*1'st Lo_D_2B*	+/-	OL	Range		Don't care				
25	*2'nd Hi_D_0B*	D1				D0				
26	*2'nd Hi_D_1B*	D3				D2				
27	*2'nd Hi_D_2B*	+/-	OL	Range		Don't care				
28	*2'nd Lo_D_0B*	D1				D0				
29	*2'nd Lo_D_1B*	D3				D2				
30	*2'nd Lo_D_2B*	+/-	OL	Range		Don't care				
31	*3'rd Hi_D_0B*	D1				D0				
32	*3'rd Hi_D_1B*	D3				D2				
33	*3'rd Hi_D_2B*	+/-	OL	Range		Don't care				
34	*3'rd Lo_D_0B*	D1				D0				
35	*3'rd Lo_D_1B*	D3				D2				
36	*3'rd Lo_D_2B*	+/-	OL	Range		Don't care				
|	|	|				|				
EndAddr	*last Hi_D_0B*	D1				D0				*1
EndAddr+1	*last Hi_D_1B*	D3				D2				
EndAddr+2	*last Hi_D_2B*	+/-	OL	Range		Don't care				
EndAddr+3	*last Lo_D_0B*	D1				D0				
EndAddr+4	*last Lo_D_1B*	D3				D2				
EndAddr+5	*last Lo_D_2B*	+/-	OL	Range		Don't care				
EndAddr+6	*CheckSum_L*									*5
EndAddr+7	*CheckSum_M*									
EndAddr+8	*CheckSum_H*									

Note:

1. Started address set of LAST "Hi-Lo data set" recorded in HEX format

EndAddr = EndAddr1 x 100H + EndAddr0 - *3AH + 1*

Example1: ***if EndAddr1=7FH & EndAddr0=F6H,***
then EndAddr = 7FH x 100H + F6H - 3AH + 1 = 7FBDH = 32701
That is to say, LAST "Hi-Lo data set" starts from no. 32701 RXD buffer.
Each "Hi-Lo data set" has 6 bytes and First "Hi-Lo data set" starts from no. 19 RXD buffer.
So Total amount of "Hi-Lo data set" is (32701-19) / 6 + 1 = 5448 in this case.

Example2: ***if EndAddr1=63H & EndAddr0=04H,***
then EndAddr = 63H x 100H + 04H - 3AH +1 = 62CBH = 25291
That is to say, LAST "Hi-Lo data set" starts from no. 25291 RXD buffer.
Each "Hi-Lo data set" has 6 bytes and First "Hi-Lo data set" starts from no. 19 RXD buffer.
So Total amount of "Hi-Lo data set" is (25291-19) / 6 + 1 = 4213 in this case.

***2. Started address set (HEX format) of the "Hi-Lo data set" where the ABSOLUTE MAXIMUM DATA of all recorded data in non-volatile memory is**

AbsMaxAddr = AbsMax_A1 x 100H + AbsMax_A0- *3AH +1*

Example1: ***if AbsMax_A1=3CH & AbsMax_A0=DCH,***
then AbsMaxAddr = 3CH x 100H + DCH - 3AH +1 = 3CA3H = 15523
thus "ABSOLUTE MAXIMUM DATA" starts from no. 15523 RXD buffer
Each "Hi-Lo data set" is recorded per minute, and (15523 - 19) /6 +1 = 2585.
That is to say,
"ABSOLUTE MAXIMUM DATA" happens at 2585th minute after starting Hi-Lo Log in this case.

***3. Started address set (HEX format) of the "Hi-Lo data set" where the ABSOLUTE MINIMUM DATA of all recorded data in non-volatile memory is**

AbsMinAddr = AbsMin_A1 x 100H + AbsMin_A0- *3AH +1*

Example1: ***if AbsMin_A1=24H & AbsMin_A0=46H,***
then AbsMinAddr = 24H x 100H + 46H - 3AH + 1 + 3 = 2410H = 9232
thus "ABSOLUTE MINIMUM DATA" starts from no. 9232 RXD buffer
Each "Hi-Lo data set" is recorded per minute, and (9232 - 3 - 19) /6 +1 = 1536.
That is to say,
"ABSOLUTE MINIMUM DATA" happens at 1536th minute after starting Hi-Lo Log in this case.

***4. Non-Volatile Memory Data Format**

D3, D2, D1 & D0 bits: BCD code

Example1: ***if (D3, D2, D1, D0) = (5, 9, 9, 2) & (DLBFunc, DLBSel, DLMode) = (01H, 00H, 00H)***
then the data is ACV 599. 2 V

PS. ***D0 means nothing to °C & °F functions and should be truncated directly***

Example2: ***if (D3, D2, D1, D0) = (1, 9, 3, 4) & (DLBFunc, DLBSel, DLMode) = (10H, 00H, 00H)***
then the data is 193 °C

"+/-" bit: Sign of recorded data (0:Positive; 1: Negative)

Example1: ***if (D3, D2, D1, D0) = (5, 9, 9, 2) & (DLBFunc, DLBSel, DLMode) = (01H, 01H, 00H) & "+/-" = 1***
then the data is DCV -599. 2 V

"OL" bit: Recorded data OL or not indication. If "OL" bit = 1, then D3~D0 bits don't care

If "OL" bit = 1, Meter's corresponding LCD digital display	ACA	ACV	DCV	°C	°F	Ω	•))	THD%-R
	OL	**OL.**	**OL.**	**---C**	**---F**	**OL.**	**OL.**	**---.-**

"Range" bits (ACA function only. Others don't care):

Range bits	00	01	10
ACA Range	40.00A	400.0A	1000A

***5. Check Sum**

Check Sum = CheckSum_H x 10000H + CheckSum_M x 100H + CheckSum_L
= SUM[(1):(EndAddr+5)]

PS.: (X) means the contents of no. X RXD buffer

Table 3. Function Encoder

Function	*DLBFunc*	*DLBSel*	*DLMode*
ACA	00H	00H	00H
ACV	01H	00H	00H
DCV	01H	01H	00H
°C	10H	00H	x
°F	10H	01H	x
Ω	11H	00H	x
•))	11H	01H	x
Hz of Voltage	01H	x	80H
Hz of ACA	00H	x	80H
THD%-R of Voltage	01H	x	01H
THD%-R of ACA	00H	x	01H

PS. "x" : don't care