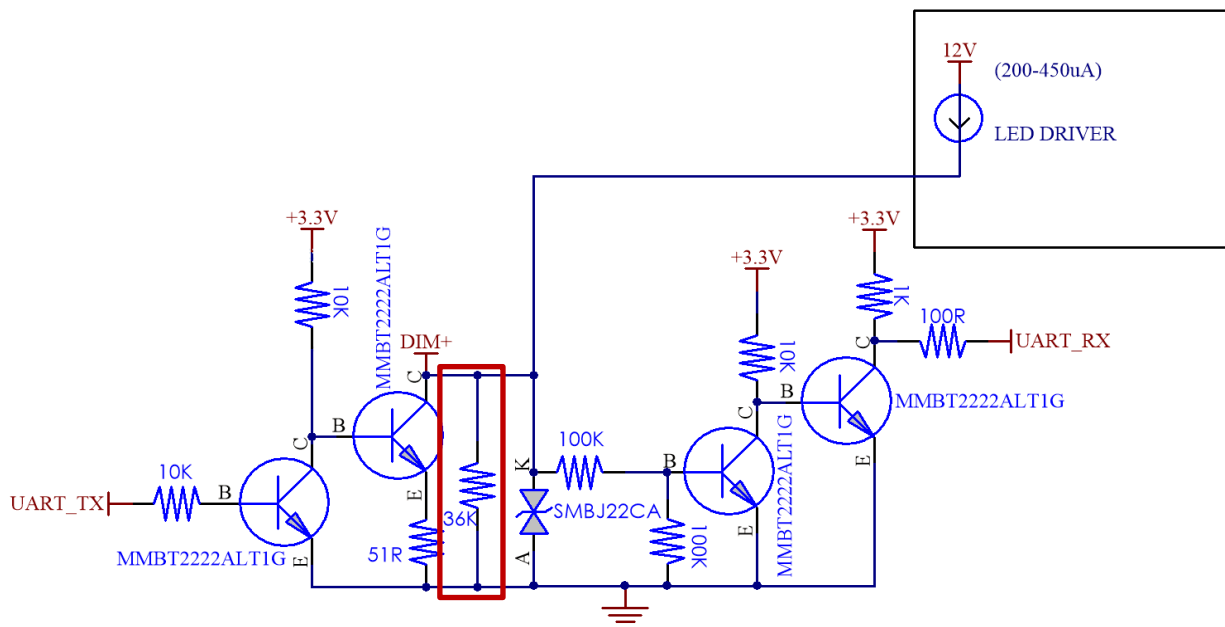


## Inventronics Digital Dimming Communication Protocol

### I. Hardware Interface Design

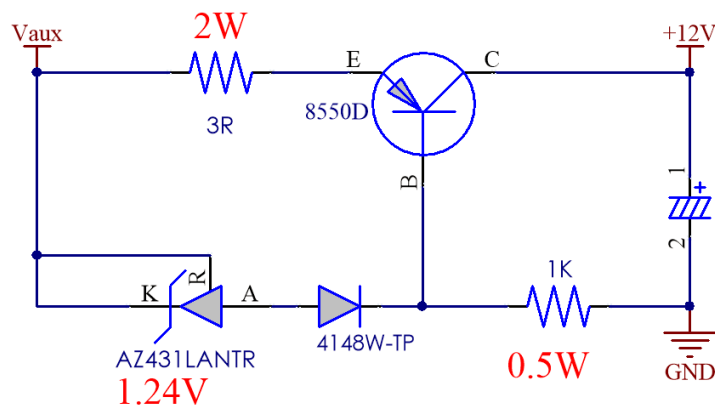
- Digital Dimming utilizes a Master-Slave single line UART communication bus
- To communicate with the driver via UART\_TX and UART\_RX, a conversion circuit is needed
- DIM+ is internally pulled high by the 12V auxiliary supply, which regulates a 200-450uA constant current supply on the DIM+ line.
- To ensure the reliability of communication, a 36kΩ resistor is required, paralleled between DIM+ and GND.

Reference design shown below:



- For NB-IOT, GPRS, and 4G systems, a current limiting circuit to the controller is required. Current must be limited to 400mA.

Reference design shown below:



## II. Data and Frame Definition

- A standard UART interface is utilized
- Each byte data is consisted of 1 start bit, 8 data bits and 1 stop bit
- Baud rate is 9600
- Interval between data frames is 60ms minimum. Recommendation is over 100ms.  
(Including intervals between send-frame and send-frame, send-frame and receive-frame)

## III. Software Protocol Definition

- Data frame includes head, command, offset address, data length, data, checksum, and two ends.
- Checksum = command + offset address + data length + data

### Available Commands:

- **Set Max Current**
  - Allows user to set output current as percentage of maximum current
- **Read Output Current**
  - Returns actual current in mA
- **Read Output Voltage**
  - Returns actual voltage in DCV
- **Read Internal Temperature**
  - Reads AD value of internal temperature, see Appendix 1 for corresponding temperature values
- **Read External Temperature**
  - Reads AD value of external NTC, see Appendix 2 for corresponding resistance values
- **Digital Dimming**
  - Allows for dimming of driver over digital dimming bus
- **Read Model Information**
  - Returns driver model, and rated power level
- **Read Current Ratio**
  - Returns the programmed output current as a percentage of the maximum output current

### Information Update Rate:

Without considering UART timing, the driver updates variables approximately every 100ms. If the dimming command or set max current command are used, it can take up to 2 seconds for the current and voltage readings to move to their final state. If read before 2 seconds, an intermittent state will be reflected.

## IV. Command List

Checksum = Command + Offset Address + Data Length + Data Bit

Head	Command	Offset Address	Data Length	Data Bit	Checksum	End	End	Definition		
0x3A	0x31	0x00	0x01	0x00-0x64		0x0D	0x0A	Set Max. current		
	0x32	0x00	0x01	If right, return 0x55, if wrong, no return				Response		
	0x3A		0x00	0x01	0x02				Read current	
			0x01	0x01	0x02				Read voltage	
			0x03	0x01	0x01				Read internal temperature (AD value)	
			0x04	0x01	0x01				Read the external temperature (AD value)	
	0x3B									Return current / voltage value
	0x3C	0x00	0x01	0x00-0xC8						Digital Dimming
	0x3D	0x00	0x01	If right, return 0x55, if wrong, no return						Response
	0x35	0x0B	0x01	0x05	0x46					Read model information
	0x36	0x0B	0x05	5 bytes						Return model information
	0x35	0x20	0x01	0x01	0x57					Read current ratio
	0x36	0x20	0x01	1 bytes						Return current ratio

## V. Command Description

- **Command 0x31 - Set Constant Power Max. Current**

Set constant power max. current to fit for LEDs applications.

The data exists in the EEPROM and is not recommended for frequent use.

To dim the driver, please use the 0x3C dimming command.

Example: Set constant power maximum current to 70% of current output (70=0x46)

Head	Command	Offset Address	Data Length	Data bit	Checksum	End	End
0x3A	0x31	0x00	0x01	0x46	0x78	0x0D	0x0A

- **Command 0x32 - Response of Command 0x31**

If data received successfully, reply is 0x55. If not, there is no reply.

Head	Command	Offset Address	Data Length	Data bit	Checksum	End	End
0x3A	0x32	0x00	0x01	0x55	0x88	0x0D	0x0A

- **Command 0x3C - Digital Dimming Command**

- Data from 0-200 corresponds to 0-100% dimming level.
- To dim driver off, send command 0. If driver does not support dim-to-off, 0 is the minimum dimming level.
- If the minimum dimming level is 10%, then all levels between 0-20 is 10%.
- All values over 200 are seen as 100% dimming level.

Example: dimming to 50% ( $50\% * 200 = 100 = 0x64$ )

Head	Command	Offset Address	Data Length	Data bit	Checksum	End	End
0x3A	0x3C	0x00	0x01	0x64	0xA1	0x0D	0x0A

- **Command 0x3D - Response from Digital Dimming Command 0x3C**

If data received successfully, reply is 0x55; if not, no reply.

- **Command 0x3A - Query Command**

- **Read Current:** Set Offset Address to 0x00  
Actual current = Return current value (mA)
- **Read Voltage:** Set offset Address to 0x01  
Actual voltage value = Return voltage value (V)

Example: Send Read Current Command

Head	Command	Offset Address	Data Length	Data bit	Checksum	End	End
0x3A	0x3A	0x00	0x01	0x02	0x3D	0x0D	0x0A

- **Command 0x3B - Query 0x3A Command Response**

Example: Receive response from Query Current Value

Head	Command	Offset Address	Data Length	Data bit	Checksum	End	End
0x3A	0x3B	0x00	0x02	0x04 0x12	0x53	0x0D	0x0A

The data 0x04 0x12 = 0 x0412 = 1042, is the actual current value (mA)

- **Command 0x35 - Read LED driver information**

Reads the information of the current model, including the rated power and the maximum rated current lomax.

Example: Read LED Driver Information

Head	Command	Offset Address	Data Length	Data bit	Checksum	End	End
0x3A	0x35	0x0B	0x01	0x05	0x46	0x0D	0x0A

Driver will return 3A36 0B 05 **01 00 96 00 69** 46 0D 0A

01 00 96 Expresses EUD150SxxxDTA, 0096 expresses power is 150W.

00 69 express Max current is 105,lomax is 1.05A.

See data format below:

**Data Format:**

Bit									
Byte	7	6	5	4	3	2	1	0	Value
0x0b	x	x	x	x	x	x	x	x	Suffix
0x0c	x	x	x	x	x	x	x	x	Prefix
0x0d	x	x	x	x	x	x	x	x	Power Level
0x0e	x	x	x	x	x	x	x	x	Model Current
0x0f	x	x	x	x	x	x	x	x	

Data	0x0B (8 Bits)								
Suffix	7	6	5	4	3	2	1	0	Hex:
xxxSxxxD(T/V)	0	0	0	0	0	0	0	0	0x00
xxxSxxxD(T/V)A	0	0	0	0	0	0	0	1	0x01
Prefix (High 5 bits of 0x0c)	7	6	5	4	3				
EUD	0	0	0	0	0				

- **Command 0x35 - Read the Maximum Current Setting loset**

Example:

Head	Command	Offset Address	Data Length	Data bit	Checksum	End	End
0x3A	0x35	0x20	0x01	0x01	0x57	0x0D	0x0A

LED driver return 3A36 20 01 **50** A7 0D 0A

0x50 expresses that the maximum current of the driver is 80% of the maximum rated current, ie  $I_{set} = I_{max} * \% = 1.05 * 80\% = 840mA$

## VI. Compatible Drivers

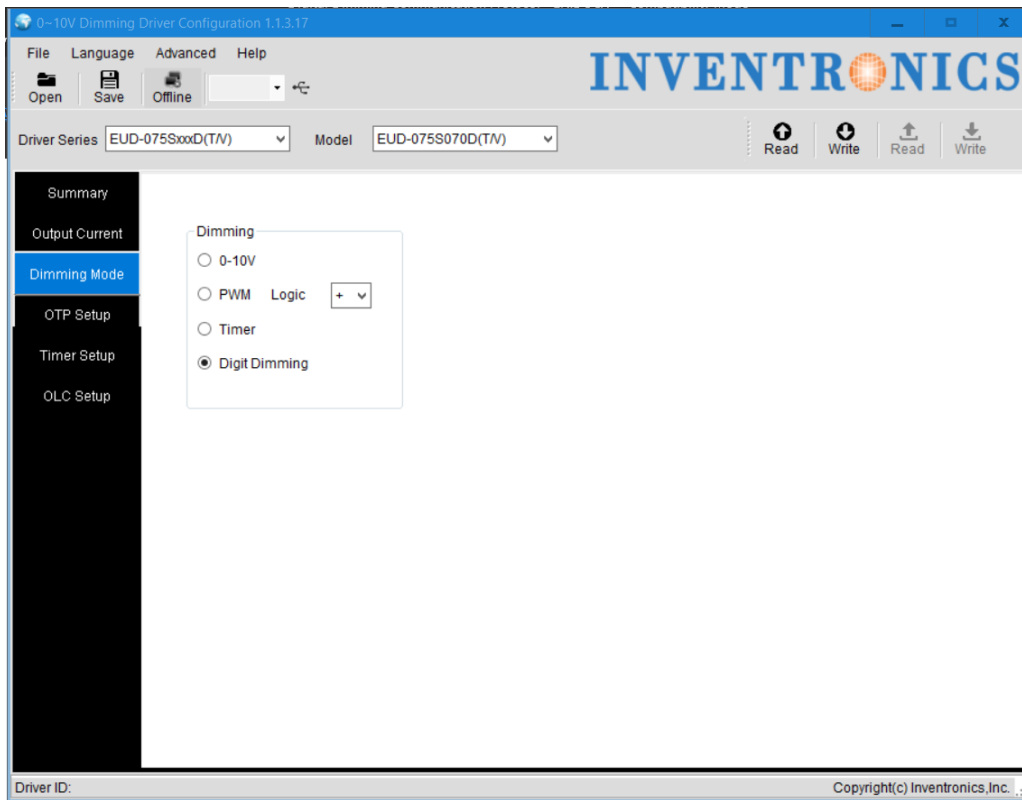
Part Number(s):	Datecode
EUD-075SxxxDx	1750
EUD-075S180DT (Class 2)	1750
EUD-096SxxxDxA	1751
EUD-096S215DTA (Class 2)	1751
EUD-150SxxxDxA	1743
EUD-200SxxxDxA	1743
EUD-240SxxxDxA	1803
ESD-480SxxxDx	/

**Note:** Datecode is listed in YYWW format, and can be found on the end-cap of each driver.

## VII. Development Tools and Digital Dimming Selection

To test and develop Digital Dimming, the Inventronics PRG-MUL2 can be used as an interface. Development software is available upon request. To utilize digital dimming, the driver dimming option must be changed to “Digit Dimming” and programmed to the driver, using the Inventronics programming software.

See screenshot below:



## Appendix I:

Internal OTP: AD value corresponds to temperature

AD value	T °C	AD value	T °C	AD value	T °C	AD value	T °C	AD value	T °C	AD value	T °C
15	125	55	76	95	54	135	38	175	23	215	4
16	123	56	75	96	54	136	38	176	22	216	4
17	121	57	74	97	53	137	37	177	22	217	3
18	118	58	74	98	53	138	37	178	22	218	2
19	116	59	73	99	52	139	37	179	21	219	2
20	114	60	72	100	52	140	36	180	21	220	1
21	112	61	72	101	52	141	36	181	20	221	0
22	111	62	71	102	51	142	36	182	20	222	0
23	109	63	71	103	51	143	35	183	20	223	-1
24	107	64	70	104	50	144	35	184	19	224	-2
25	105	65	69	105	50	145	34	185	19	225	-2
26	104	66	69	106	50	146	34	186	18	226	-3
27	103	67	68	107	49	147	34	187	18	227	-4
28	101	68	68	108	49	148	33	188	17	228	-5
29	100	69	67	109	48	149	33	189	17	229	-5
30	98	70	66	110	48	150	33	190	17	230	-6
31	97	71	66	111	47	151	32	191	16	231	-7
32	96	72	65	112	47	152	32	192	16	232	-8
33	95	73	65	113	47	153	31	193	15	233	-9
34	94	74	64	114	46	154	31	194	15	234	-10
35	93	75	64	115	46	155	31	195	14	235	-11
36	91	76	63	116	45	156	30	196	14	236	-12
37	90	77	63	117	45	157	30	197	13	237	-13
38	89	78	62	118	45	158	29	198	13	238	-14
39	88	79	62	119	44	159	29	199	13	239	-15
40	88	80	61	120	44	160	29	200	12	240	-16
41	87	81	61	121	44	161	28	201	12	241	-17
42	86	82	60	122	43	162	28	202	11	242	-18
43	85	83	60	123	43	163	28	203	11	243	-20
44	84	84	59	124	42	164	27	204	10	244	-21
45	83	85	59	125	42	165	27	205	10	245	-23
46	82	86	58	126	42	166	26	206	9	246	-25
47	82	87	58	127	41	167	26	207	9	247	-27
48	81	88	57	128	41	168	26	208	8	248	-29
49	80	89	57	129	40	169	25	209	7	249	-31
50	79	90	56	130	40	170	25	210	7	250	-34
51	78	91	56	131	40	171	24	211	6	251	-38
52	78	92	56	132	39	172	24	212	6	252	-40
53	77	93	55	133	39	173	24	213	5		
54	76	94	55	134	39	174	23	214	5		



## Appendix II :

External OTP: AD value corresponds to the resistance value (external OTP resistance recommended 10K)

AD value	$\Omega$	AD value	$\Omega$	AD value	$\Omega$	AD value	$\Omega$	AD value	$\Omega$	AD value	$\Omega$
1	20	40	949	124	4827	163	9036	202	19438	241	87793
2	40	41	977	125	4904	164	9191	203	19910	242	94938
3	61	42	1006	126	4981	165	9350	204	20400	243	103275
4	81	43	1034	127	5060	166	9512	205	20910	244	113127
5	102	44	1064	128	5140	167	9678	206	21441	245	124950
6	123	45	1093	129	5221	168	9848	207	21994	246	139400
7	144	91	2830	130	5304	169	10022	208	22570	247	157463
8	165	92	2879	131	5388	170	10200	209	23172	248	180686
9	187	93	2928	132	5473	171	10382	210	23800	249	211650
10	208	94	2978	133	5560	172	10569	211	24457	250	255000
11	230	95	3028	134	5648	173	10760	212	25144	251	320025
12	252	96	3079	135	5738	174	10956	213	25864	252	428400
13	274	97	3131	136	5829	175	11156	214	26620	253	645150
14	296	98	3183	137	5921	176	11362	215	27413	254	1295400
15	319	99	3237	138	6015	177	11573	216	28246		
16	341	100	3290	139	6111	178	11790	217	29124		
17	364	101	3345	140	6209	179	12012	218	30049		
18	387	102	3400	141	6308	180	12240	219	31025		
19	411	103	3456	142	6409	181	12474	220	32057		
20	434	104	3513	143	6512	182	12715	221	33150		
21	458	105	3570	144	6616	183	12963	222	34309		
22	482	106	3628	145	6723	184	13217	223	35541		
23	506	107	3687	146	6831	185	13479	224	36852		
24	530	108	3747	147	6942	186	13748	225	38250		
25	554	109	3808	148	7054	187	14025	226	39745		
26	579	110	3869	149	7169	188	14310	227	41346		
27	604	111	3931	150	7286	189	14605	228	43067		
28	629	112	3994	151	7405	190	14908	229	44919		
29	654	113	4058	152	7526	191	15220	230	46920		
30	680	114	4123	153	7650	192	15543	231	49088		
31	706	115	4189	154	7776	193	15876	232	51443		
32	732	116	4256	155	7905	194	16220	233	54014		
33	758	117	4324	156	8036	195	16575	234	56829		
34	785	118	4393	157	8170	196	16942	235	59925		
35	811	119	4463	158	8307	197	17322	236	63347		
36	838	120	4533	159	8447	198	17716	237	67150		
37	866	121	4605	160	8589	199	18123	238	71400		
38	893	122	4678	161	8735	200	18545	239	76181		
39	921	123	4752	162	8884	201	18983	240	81600		

## Disclaimer

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Inventronics (Hangzhou), INC.

## Revision History

Change Date	Rev.	Description of Change		
		Item	From	To
2018-12-20	A	Release	/	/
2019-01-31	B	I. Hardware Interface Design	/	Updated
2019-04-08	C	V. Command Description - Data Format	/	Updated
		VI. Compatible Drivers	Firmware	Deleted
		Note of Compatible Drivers	/	Updated
2019-05-22	D	VI. Compatible Drivers	ESD-480SxxxDx	Added