XICATO

XIM DALI User Guide

Rev 1.1

Document Revision History

Date	Section(s)	Action	Notes	Rev no.
10/22/2014		Released	Preliminary release	1.0
07/02/2015	1.0		Updated GTIN table to include 95/V9 products	1.1

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1.0 Introduction

This document is intended to provide a description of the feature and functions of the Xicato XIM products that have an integrated DALI control interface. Listed in the table below are all of the Xicato part numbers that this document is applicable to as well as the physical properties of the part and the GTIN value (stored in memory bank 0) associated with the part. All of the parts listed are compliant with Edition 1.0 of the referenced DALI standards (i.e., "DALI 1.0" compliant).

Table 1 - XIM Device Part Number to GTIN Mapping

	Physical Properties				GTIN						
Part Number	LES	CRI	CCT	Flux	Decimal value	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
XIM19V83013A2A	19	V8	3000	1300	0812622020010	00	BD	34	0B	FD	AA
XIM19802713A2A	19	80	2700	1300	0812622020027	00	BD	34	0B	FD	BB
XIM19803013A2A	19	80	3000	1300	0812622020034	00	BD	34	0B	FD	C2
XIM19803513A2A	19	80	3500	1300	0812622020041	00	BD	34	0B	FD	C9
XIM19804013A2A	19	80	4000	1300	0812622020058	00	BD	34	0B	FD	DA
XIM19V83020A2A	19	V8	3000	2000	0812622020065	00	BD	34	0B	FD	E1
XIM19802720A2A	19	80	2700	2000	0812622020072	00	BD	34	0B	FD	E8
XIM19803020A2A	19	80	3000	2000	0812622020089	00	BD	34	0B	FD	F9
XIM19803520A2A	19	80	3500	2000	0812622020096	00	BD	34	0B	FE	00
XIM19804020A2A	19	80	4000	2000	0812622020102	00	BD	34	0B	FE	06
XIM19952713A2A	19	95	2700	1300	0812622020119	00	BD	34	0B	FE	17
XIM19953013A2A	19	95	3000	1300	0812622020126	00	BD	34	0B	FE	1E
XIM19953513A2A	19	95	3500	1300	0812622020133	00	BD	34	0B	FE	25
XIM19954013A2A	19	95	4000	1300	0812622020140	00	BD	34	0B	FE	2C
XIM19V93013A2A	19	V9	3000	1300	0812622020157	00	BD	34	0B	FE	3D

Note that this document is not intended to supplant or replace the IEC documents that define the DALI Standard, it is only intended to define how the XIM DALI modules will operate when connected to a DALI based lighting control system (i.e., DALI Master). If there are any conflicts in the description of DALI operation between this document and the referenced IEC documents, the IEC documents take precedence.

1.1 Referenced Documents

1.1.1 DALI Standard

- IEC 62386-101 (General Requirements - System)
- IEC 62386-102 (General Requirements - Control Gear)
- IEC 62386-207 (Particular Requirements – LED Modules)

1.2 Naming Conventions

Table 2 - Naming Conventions

Name	Description
CORE	Proprietary Xicato technology (component) that generates the LED light
DALI	Digital Addressable Lighting Interface
GTIN	Global Trade Identification Number
Module	Complete XIM assembly (enclosure, core, electronics, thermal base)
VIN	Input supply voltage

2.0 XIM Operation

2.1 Dimming Curve

The XIM supports both the logarithmic dimming curve that is specified in IEC 62386-102 and the linear dimming curve that is specified in IEC 62386-207. The logarithmic curve is programmed as the default configuration. The curve selected can be changed by executing DALI Command 227 (SELECT DIMMING CURVE).

2.1.1 Logarithmic Dimming

The dimming range supported when using the logarithmic curve is from 0.1% (level 1) to 100% (level 254) as defined in IEC 62386-102. In addition to supporting a minimum dimming level of 0.1%, the XIM will dim the light to off when commanded to level 0.

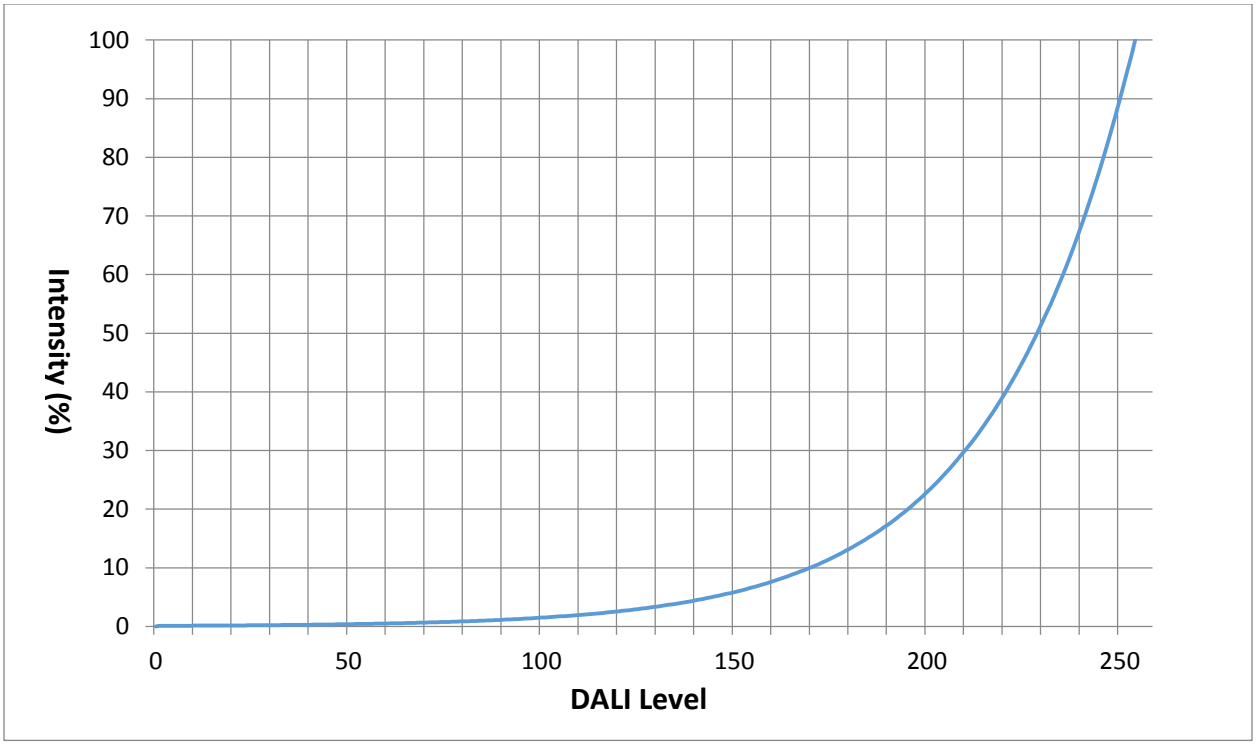

Figure 1. DALI Logarithmic Dimming Curve

Table 3 - DALI Logarithmic Dimming Table

Level	Intensity	Level	Intensity	Level	Intensity	Level	Intensity	Level	Intensity	Level	Intensity
1	0.100	44	0.324	87	1.047	130	3.386	173	10.953	216	35.433
2	0.103	45	0.332	88	1.076	131	3.479	174	11.256	217	36.414
3	0.106	46	0.342	89	1.105	132	3.576	175	11.568	218	37.422
4	0.109	47	0.351	90	1.136	133	3.675	176	11.888	219	38.457
5	0.112	48	0.361	91	1.167	134	3.776	177	12.217	220	39.522
6	0.115	49	0.371	92	1.200	135	3.881	178	12.555	221	40.616
7	0.118	50	0.381	93	1.233	136	3.988	179	12.902	222	41.740
8	0.121	51	0.392	94	1.267	137	4.099	180	13.260	223	42.895
9	0.124	52	0.402	95	1.302	138	4.212	181	13.627	224	44.083
10	0.128	53	0.414	96	1.338	139	4.329	182	14.004	225	45.303
11	0.131	54	0.425	97	1.375	140	4.449	183	14.391	226	46.557
12	0.135	55	0.437	98	1.413	141	4.572	184	14.790	227	47.846
13	0.139	56	0.449	99	1.452	142	4.698	185	15.199	228	49.170
14	0.143	57	0.461	100	1.492	143	4.828	186	15.620	229	50.531
15	0.147	58	0.474	101	1.534	144	4.962	187	16.052	230	51.930
16	0.151	59	0.487	102	1.576	145	5.099	188	16.496	231	53.367
17	0.155	60	0.501	103	1.620	146	5.240	189	16.953	232	54.844
18	0.159	61	0.515	104	1.665	147	5.385	190	17.422	233	56.362
19	0.163	62	0.529	105	1.711	148	5.535	191	17.905	234	57.922
20	0.168	63	0.543	106	1.758	149	5.688	192	18.400	235	59.526
21	0.173	64	0.559	107	1.807	150	5.845	193	18.909	236	61.173
22	0.177	65	0.574	108	1.857	151	6.007	194	19.433	237	62.866
23	0.182	66	0.590	109	1.908	152	6.173	195	19.971	238	64.607
24	0.187	67	0.606	110	1.961	153	6.344	196	20.524	239	66.395
25	0.193	68	0.623	111	2.015	154	6.520	197	21.092	240	68.233
26	0.198	69	0.640	112	2.071	155	6.700	198	21.675	241	70.121
27	0.203	70	0.658	113	2.128	156	6.886	199	22.275	242	72.062
28	0.209	71	0.676	114	2.187	157	7.076	200	22.892	243	74.057
29	0.215	72	0.695	115	2.248	158	7.272	201	23.526	244	76.107
30	0.221	73	0.714	116	2.310	159	7.473	202	24.177	245	78.213
31	0.227	74	0.734	117	2.374	160	7.680	203	24.846	246	80.378
32	0.233	75	0.754	118	2.440	161	7.893	204	25.534	247	82.603
33	0.240	76	0.775	119	2.507	162	8.111	205	26.241	248	84.889
34	0.246	77	0.796	120	2.577	163	8.336	206	26.967	249	87.239
35	0.253	78	0.819	121	2.648	164	8.567	207	27.713	250	89.654
36	0.260	79	0.841	122	2.721	165	8.804	208	28.480	251	92.135
37	0.267	80	0.864	123	2.797	166	9.047	209	29.269	252	94.686
38	0.275	81	0.888	124	2.874	167	9.298	210	30.079	253	97.307
39	0.282	82	0.913	125	2.954	168	9.555	211	30.911	254	100.000
40	0.290	83	0.938	126	3.035	169	9.820	212	31.767		
41	0.298	84	0.964	127	3.119	170	10.091	213	32.646		
42	0.306	85	0.991	128	3.206	171	10.371	214	33.550		
43	0.315	86	1.018	129	3.294	172	10.658	215	34.479		

2.1.2 Linear Dimming

The dimming range supported when using the linear curve is from 0.394% (level 1) to 100% (level 254) as defined by the formula in IEC 62386-207. In addition to supporting a minimum dimming level of 0.394% when using a linear dimming curve, the XIM will dim the light to off when commanded to level 0.

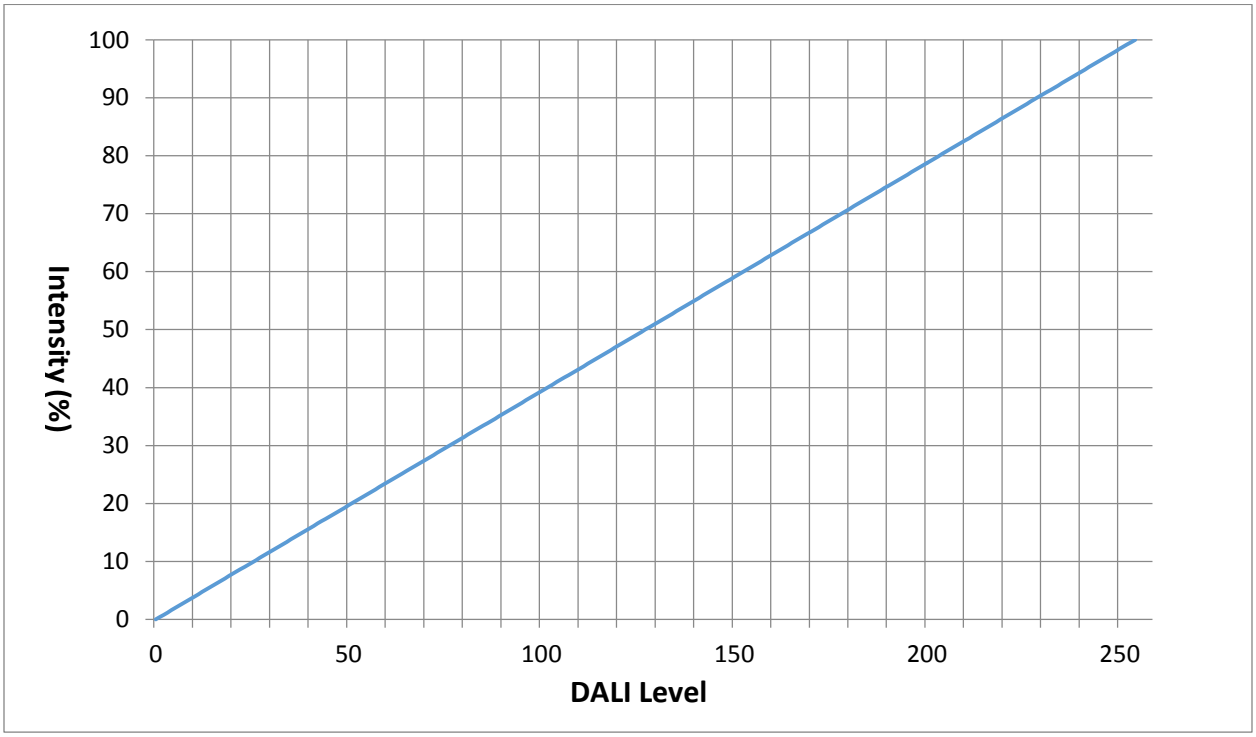

Figure 2. DALI Linear Dimming Curve

Table 4. DALI Linear Dimming Table

Level	Intensity	Level	Intensity	Level	Intensity	Level	Intensity	Level	Intensity	Level	Intensity
1	0.394	44	17.323	87	34.252	130	51.181	173	68.110	216	85.039
2	0.787	45	17.717	88	34.646	131	51.575	174	68.504	217	85.433
3	1.181	46	18.110	89	35.039	132	51.969	175	68.898	218	85.827
4	1.575	47	18.504	90	35.433	133	52.362	176	69.291	219	86.220
5	1.969	48	18.898	91	35.827	134	52.756	177	69.685	220	86.614
6	2.362	49	19.291	92	36.220	135	53.150	178	70.079	221	87.008
7	2.756	50	19.685	93	36.614	136	53.543	179	70.472	222	87.402
8	3.150	51	20.079	94	37.008	137	53.937	180	70.866	223	87.795
9	3.543	52	20.472	95	37.402	138	54.331	181	71.260	224	88.189
10	3.937	53	20.866	96	37.795	139	54.724	182	71.654	225	88.583
11	4.331	54	21.260	97	38.189	140	55.118	183	72.047	226	88.976
12	4.724	55	21.654	98	38.583	141	55.512	184	72.441	227	89.370
13	5.118	56	22.047	99	38.976	142	55.906	185	72.835	228	89.764
14	5.512	57	22.441	100	39.370	143	56.299	186	73.228	229	90.157
15	5.906	58	22.835	101	39.764	144	56.693	187	73.622	230	90.551
16	6.299	59	23.228	102	40.157	145	57.087	188	74.016	231	90.945
17	6.693	60	23.622	103	40.551	146	57.480	189	74.409	232	91.339
18	7.087	61	24.016	104	40.945	147	57.874	190	74.803	233	91.732
19	7.480	62	24.409	105	41.339	148	58.268	191	75.197	234	92.126
20	7.874	63	24.803	106	41.732	149	58.661	192	75.591	235	92.520
21	8.268	64	25.197	107	42.126	150	59.055	193	75.984	236	92.913
22	8.661	65	25.591	108	42.520	151	59.449	194	76.378	237	93.307
23	9.055	66	25.984	109	42.913	152	59.843	195	76.772	238	93.701
24	9.449	67	26.378	110	43.307	153	60.236	196	77.165	239	94.094
25	9.843	68	26.772	111	43.701	154	60.630	197	77.559	240	94.488
26	10.236	69	27.165	112	44.094	155	61.024	198	77.953	241	94.882
27	10.630	70	27.559	113	44.488	156	61.417	199	78.346	242	95.276
28	11.024	71	27.953	114	44.882	157	61.811	200	78.740	243	95.669
29	11.417	72	28.346	115	45.276	158	62.205	201	79.134	244	96.063
30	11.811	73	28.740	116	45.669	159	62.598	202	79.528	245	96.457
31	12.205	74	29.134	117	46.063	160	62.992	203	79.921	246	96.850
32	12.598	75	29.528	118	46.457	161	63.386	204	80.315	247	97.244
33	12.992	76	29.921	119	46.850	162	63.780	205	80.709	248	97.638
34	13.386	77	30.315	120	47.244	163	64.173	206	81.102	249	98.031
35	13.780	78	30.709	121	47.638	164	64.567	207	81.496	250	98.425
36	14.173	79	31.102	122	48.031	165	64.961	208	81.890	251	98.819
37	14.567	80	31.496	123	48.425	166	65.354	209	82.283	252	99.213
38	14.961	81	31.890	124	48.819	167	65.748	210	82.677	253	99.606
39	15.354	82	32.283	125	49.213	168	66.142	211	83.071	254	100.000
40	15.748	83	32.677	126	49.606	169	66.535	212	83.465		
41	16.142	84	33.071	127	50.000	170	66.929	213	83.858		
42	16.535	85	33.465	128	50.394	171	67.323	214	84.252		
43	16.929	86	33.858	129	50.787	172	67.717	215	84.646		

2.2 Power On

The XIM detects power on when the input voltage (VIN) goes above 40.0V. When a power on condition is detected the XIM enters its normal operating mode, and it will be able to react to DALI commands no later than 200ms (0.2s) after power-on detection.

The XIM follows the power-on behavior defined in section 9.2 of IEC 62386-102.

Each time the XIM powers on from a power off state, the XIM power cycle counter will be incremented (refer to section 3.7 for details).

2.2.1 Start Up Intensity

The default value for the POWER-ON LEVEL is 254 (i.e., 100% intensity). This value can be changed by executing DALI command 45 (STORE THE DTR AS POWER ON LEVEL). If the POWER ON LEVEL is changed in the XIM, then that value will persist as the default value until a new POWER ON LEVEL is loaded into the XIM.

The maximum intensity that the XIM will go to for the POWER ON LEVEL is limited to what is set as the MAX LEVEL (refer to section 2.4 below). For example, if the MAX LEVEL is set to 229 (50.5% intensity), the XIM will only go to level 229 if the POWER-ON LEVEL is set to a value above 229.

2.2.2 Brown-out behavior

In addition to monitoring the DALI bus voltage, the XIM will also monitor VIN to ensure that it remains above the power on voltage. If VIN drops below 30V, the XIM considers that a power off condition and will turn off the light immediately. The processor on the XIM will continue to monitor VIN even while it is below 30V. If VIN is maintained above 6V, but below 30V, the XIM is considered to be operating in a brown-out condition. The XIM will continue to monitor VIN and will respond to DALI query or memory read commands. When VIN rises above 40V, the XIM will power on and behaves as if it had just detected a power on from a completely off state including incrementing the XIM power cycle and LED power cycle counters.

2.3 Interface Failure

The XIM will follow the interface-failure behavior defined in section 9.3 of IEC 62386-102.

2.4 Min and Max Level

The XIM follows the MIN LEVEL and MAX LEVEL behavior defined in section 9.4 of IEC 62386-102.

2.5 Fade Time and Fade Rate

The XIM supports a maximum fade rate of 1 DALI step per millisecond. This is the fade rate that is used for any DALI command that requires an immediate response without fading (e.g., OFF, STEP UP, STEP DOWN, RECALL MAX LEVEL, RECALL MIN LEVEL, etc.). In addition, this is the default fade rate factory programmed into the XIM, and it is the fade rate used if both the Fade Time and Fast Fade Time indexes are set to 0.

2.5.1 Fade Times and Fade Rates

The XIM supports all of the fade times and fade rates defined in section 9.5 of IEC 62386-102. In addition, when the fade time index value (X) is set to 0, the XIM will support fast fade times as defined in IEC 62386-207.

The currently set Fade Time and Fade Rate can be read out by executing DALI command 165 (QUERY FADE TIME/FADE RATE), with the high order nibble (bits 7-4) representing the Fade Time index and the low order nibble (bits 3-0) representing the Fade Rate index. The Fade Time index can be changed by executing DALI command 46 (STORE THE DTR AS FADE TIME). The Fade Rate index can be changed by executing DALI command 47 (STORE THE DTR AS FADE RATE). Note that there is no requirement for the Fade Time and Fade Rate indexes to be the same value.

Table 5. Fade Times (in seconds)

Index	Fade Time	Index	Fade Time	Index	Fade Time	Index	Fade Time
0	See Fast Fade	4	2.0	8	8.0	12	32.0
1	0.7	5	2.8	9	11.3	13	45.3
2	1.0	6	4.0	10	16.0	14	64.0
3	1.4	7	5.7	11	22.6	15	90.5

Table 6. Fade Rates (in steps/second)

Index	Fade Rate	Index	Fade Rate	Index	Fade Rate	Index	Fade Rate
0	Not applicable	4	127	8	31.6	12	7.9
1	358	5	89.4	9	22.4	13	5.6
2	253	6	63.3	10	15.8	14	4.0
3	179	7	44.7	11	11.2	15	2.8

2.5.2 Fast Fade Times

The XIM supports fast fade times, as defined in IEC62386-207, from 300ms (DALI Fast Fade Time index = 12) to 675ms (DALI Fast Fade Time index =27). If the Fast Fade Time index is set to 0, fades will be performed at the at the maximum fade rate of 1 DALI step per millisecond. If the Fast Fade Time index is set to any value from 1 to 11 (not supported by the XIM), the XIM will set the index value to 12.

The currently set Fast Fade Time can be read out by executing DALI command 253 (QUERY FAST FADE TIME), which will return the Fast Fade Time index value. The Fast Fade Time index can be changed by executing DALI command 228 (STORE DTR AS FAST FADE TIME).

Table 7. Fast Fade Times (in seconds)

Index	FADE Time	Index	FADE Time	Index	FADE Time
0	Immediate Fade	16	0.400	22	0.550
1-11	Not Supported	17	0.425	23	0.575
12	0.300	18	0.450	24	0.600
13	0.325	19	0.475	25	0.625
14	0.350	20	0.500	26	0.650
15	0.375	21	0.525	27	0.675

3.0 Memory Map and Data Storage

The XIM supports a total of 12 device memory banks. The first two banks (bank 0 and bank 1) conform to the requirements defined in IEC 62386-102. There are ten additional memory banks in the XIM, of which four are reserved by Xicato for internal use and six are used to provide additional real time and historical operating data of the module. The mapping of the memory banks is listed in Table 4 below.

Data is read from the memory banks by executing DALI command 197 (READ MEMORY LOCATION), and data can be written to bank 1 by executing DALI command 275 (WRITE MEMORY LOCATION). Please refer to section 3.0 DALI Supported Commands of this document and IEC 62386-102 for more details on how to perform memory read and write commands.

Table 8. XIM Memory Banks

Bank	Description	Size (bytes)	Access
0	Gear Information (Fixed)	23	R
1	OEM Information	32	R/W
2	Reserved - Xicato Internal Use	-	R
3	LED Operating Temperature History	36	R
4	LED Intensity History	33	R
5	LED Vf History	63	R
6	DALI Operation History	15	R
7	Additional Historical Data	33	R
8	Real-Time Data	15	R
9-11	Reserved - Xicato Internal Use	-	R

Note that for memory banks 3 through 8, the data in the memory bank is refreshed by executing DALI command 273 (*set* DATA TRANSFER REGISTER (DTR1) *value*) with the value loaded into DTR1. If multiple memory banks are being read from, this will occur naturally since value of DTR1 is the memory bank to be accessed; however, if the same memory bank is read from repeatedly, then the bank value (0, 1, 3, etc.) must be reloaded into DTR1 to refresh the data in the memory bank.

Note that while data may be returned from read accesses to Banks 2, 9, 10 and 11, any data returned by the XIM from those memory banks should be considered undefined. The definition of the data contained in memory banks 0, 1 and 3 through 8 are defined in the following sections.

3.1 Memory Bank 0: Gear Information

The data contained in bank 0 matches what is defined in the DALI specification IEC 62386-102, with the addition of 8 more bytes (a total of 12) for the device serial number. In addition, the Global Trade Identification Number (GTIN) is unique for each device part number.

Tables 5 and 6 below show the byte mapping in the memory bank, and the GTIN for each device part number.

Table 9. Gear Information

Offset	Description	Default	Memory Access
0	Last Accessible Address Location	22	Read-only
1	Bank 0 Checksum	*	Read-only
2	Last accessible memory bank	11	Read-only
3	GTIN byte 0 (MSB)	Refer to Table 2	Read-only
4	GTIN byte 1		Read-only
5	GTIN byte 2		Read-only
6	GTIN byte 3		Read-only
7	GTIN byte 4		Read-only
8	GTIN byte 5		Read-only
9	Control gear firmware version (major)	Xicato controlled	Read-only
10	Control gear firmware version (minor)		Read-only
11	Serial number byte 1 (MSB)	Unique for each module	Read-only
12	Serial number byte 2		Read-only
13	Serial number byte 3		Read-only
14	Serial number byte 4		Read-only
15	Serial number byte 5		Read-only
16	Serial number byte 6		Read-only
17	Serial number byte 7		Read-only
18	Serial number byte 8		Read-only
19	Serial number byte 9		Read-only
20	Serial number byte 10		Read-only
21	Serial number byte 11		Read-only
22	Serial number byte 12		Read-only

* The checksum is calculated based on the GTIN, firmware version and serial number for each module.

3.2 Memory Bank 1: OEM Information

The data contained in bank 1 matches what is defined in the DALI specification IEC 62386-102, with the addition of 16 more bytes of free memory space available to the OEM for any use. Note that Xicato does not require values to be loaded into this memory bank by the OEM, nor does Xicato control the value(s) loaded into this memory bank by the OEM.

Table 10. OEM Information

Offset	Description	Default	Memory Access
0	Last Accessible Address Location	31	Read-only
1	Checksum	30*	Read-only
2	Lock Byte	255	Read/Write
3	OEM GTIN byte 0 (MSB)	255	Read/Write (Lockable)
4	OEM GTIN byte 1	255	Read/Write (Lockable)
5	OEM GTIN byte 2	255	Read/Write (Lockable)
6	OEM GTIN byte 3	255	Read/Write (Lockable)
7	OEM GTIN byte 4	255	Read/Write (Lockable)
8	OEM GTIN byte 5	255	Read/Write (Lockable)
9	OEM serial number byte 1 (MSB)	255	Read/Write (Lockable)
10	OEM serial number byte 2	255	Read/Write (Lockable)
11	OEM serial number byte 3	255	Read/Write (Lockable)
12	OEM serial number byte 4	255	Read/Write (Lockable)
13	Subsystem (bit 4 to bit 7) Device number (bit 0 to bit 3)	255	Read/Write (Lockable)
14	Lamp type number (lockable)	255	Read/Write (Lockable)
15	Lamp type number	255	Read/Write (Lockable)
16	OEM Free Use	255	Read/Write (Lockable)
17	OEM Free Use	255	Read/Write (Lockable)
18	OEM Free Use	255	Read/Write (Lockable)
19	OEM Free Use	255	Read/Write (Lockable)
20	OEM Free Use	255	Read/Write (Lockable)
21	OEM Free Use	255	Read/Write (Lockable)
22	OEM Free Use	255	Read/Write (Lockable)
23	OEM Free Use	255	Read/Write (Lockable)
24	OEM Free Use	255	Read/Write (Lockable)
25	OEM Free Use	255	Read/Write (Lockable)
26	OEM Free Use	255	Read/Write (Lockable)
27	OEM Free Use	255	Read/Write (Lockable)
28	OEM Free Use	255	Read/Write (Lockable)
29	OEM Free Use	255	Read/Write (Lockable)
30	OEM Free Use	255	Read/Write (Lockable)
31	OEM Free Use	255	Read/Write (Lockable)

* The checksum shown is based on the default module values. The checksum will be recalculated based on new byte values loaded by the OEM.

3.3 Memory Bank 3: Operating Temperature History

The XIM maintains a history of operating temperature of the LED over each hour of use that the LED is turned on and operating (i.e., intensity ≥ 0.1%). The LED temperature recorded corresponds to the Tc measurement point of the XIM. This data can be used to build a histogram of the LED operating temperature. Note that the data is persistent in the XIM, so the data read out from the XIM at any given point in time represents all historical LED operating temperature data captured by the XIM to that point in time.

After an hour in which the LED is operating elapses, the maximum temperature of the LED during that hour is recorded and the corresponding temperature range bucket is incremented. There are a total of 11 temperature range buckets, with all but the lowest (capturing any operation below 50°C) and highest (capturing any operation at or above 95°C) representing a 5°C range. Refer to table 8 for the temperature range of each bucket and the memory offset of each bucket within the memory bank.

Note that for any given hour of LED operation that only a single temperature range bucket, representing the maximum temperature over the preceding hour, will be incremented. For example, if the LED is turned on and it slowly increases in temperature from 40°C to 72°C in an hour of operation, only the bucket that corresponds to the range from ≥70°C to <75°C (offset 18) will be incremented at the end of the hour.

Table 11. Thermal History Data

Offset	Description	Length*	Default
0	Last Accessible Address Location	1	35
1	Checksum	1	1**
2	Lock Byte	1	255
3	LED Operation, Hours at <50°C bucket (MSB first)	3	0
6	LED Operation, Hours at ≥50 to <55°C bucket	3	0
9	LED Operation, Hours at ≥55 to <60°C bucket	3	0
12	LED Operation, Hours at ≥60 to <65°C bucket	3	0
15	LED Operation, Hours at ≥65 to <70°C bucket	3	0
18	LED Operation, Hours at ≥70 to <75°C bucket	3	0
21	LED Operation, Hours at ≥75 to <80°C bucket	3	0
24	LED Operation, Hours at ≥80 to <85°C bucket	3	0
27	LED Operation, Hours at ≥85 to <90°C bucket	3	0
30	LED Operation, Hours at ≥90 to <95°C bucket	3	0
33	LED Operation, Hours at ≥95°C bucket	3	0

* For all multi-byte values (length >1), the first byte (lowest offset) contains the MSB

** The checksum shown is based on the default module values. The checksum will be recalculated based on histogram data being updated during device operation.

The maximum value that can be recorded in any bucket is 200,000, which corresponds to 200,000 hours (~23 years) of operation at that temperature.

3.4 Memory Bank 4: LED Intensity History

The XIM maintains a history of minimum and maximum LED intensity over each hour that the XIM is operating (i.e., VIN ≥ 40.0V) whether the LED is turned on or turned off (i.e., intensity = 0). This data can be used to build a histogram of the LED Intensity. Note that the data is persistent in the XIM, so the data read out from the XIM at any given point in time represents all historical LED Intensity data captured by the XIM to that point in time.

After each hour in which the XIM is operating elapses, the minimum and maximum intensities of the LED during that hour are recorded and the corresponding intensity range buckets (minimum and maximum) are incremented. There are a total of 5 minimum intensity range buckets and 5 maximum intensity range buckets. Refer to Table 12. Intensity History Data for the intensity range of each bucket and the memory offset of each bucket within the memory bank.

Note that for any given hour of XIM operation that both a minimum intensity range and maximum intensity range bucket will be incremented. For example, if the LED intensity is changed from 25% intensity to 5% intensity and then to off over the course of an hour of XIM operation, the minimum intensity bucket that corresponds to off (Offset 3) and the maximum intensity bucket corresponding to the ≥10% to <50% range (Offset 27) will be incremented at the end of that hour. Further, if the module then remained off for another hour, the minimum intensity bucket and the maximum intensity bucket corresponding to off (Offsets 3 and 18, respectively) would be incremented at the end of that hour.

Table 12. Intensity History Data

Offset	Description	Length*	Default
0	Last Accessible Address Location	1	32
1	Checksum	1	1
2	Lock Byte	1	255
3	Minimum LED Intensity, Hours at off (MSB first)	3	0
6	Minimum LED Intensity, Hours at ≥0.1% to <1.0%	3	0
9	Minimum LED Intensity, Hours at ≥1.0% to <10%	3	0
12	Minimum LED Intensity, Hours at ≥10 to <50%	3	0
15	Minimum LED Intensity, Hours at ≥50 to ≤100%	3	0
18	Maximum LED Intensity, Hours at off	3	0
21	Maximum LED Intensity, Hours at ≥0.1 to <1.0%	3	0
24	Maximum LED Intensity, Hours at ≥1.0 to <10%	3	0
27	Maximum LED Intensity, Hours at ≥10 to <50%	3	0
30	Maximum LED Intensity, Hours at ≥50 to ≤100%	3	0

* For all multi-byte values (length >1), the first byte (lowest offset) contains the MSB

The maximum value that can be recorded in any bucket is 200,000, which corresponds to 200,000 hours (~23 years) of operation at that temperature.

3.5 Memory Bank 5: LED Forward Voltage History

The XIM maintains a history of the minimum and maximum forward voltage (Vf) of the LED over each hour of use that the LED is turned on and operating at an intensity of ~25% or above (Vf capture

threshold). This data can be used to build a histogram of the LED Vf. Note that the data is persistent in the XIM, so the data read out from the XIM at any given point in time represents all historical LED Vf data captured by the XIM to that point in time.

After each hour in which the LED has operated at or above the Vf capture threshold, the minimum and maximum Vf of the LED during that hour are recorded and the corresponding Vf range buckets (minimum and maximum) are incremented. There are a total of 10 minimum Vf range buckets and 10 maximum Vf range buckets. Refer to Table 13. Vf History DataTable 13 for the Vf range of each bucket and the memory offset of each bucket within the memory bank. Note that for each hour (or any portion of that hour) of LED operation in which the intensity was at or above the Vf capture threshold, both a minimum Vf range bucket and maximum Vf range bucket will be incremented. If the intensity remains below the Vf capture threshold for the entire hour, then none of the Vf range buckets will be incremented.

For all Vf ranges, they are relative to the Vf reference voltage (VF_REFERENCE) that is captured after the first 5 minutes of LED operation above the Vf capture threshold, refer to section 3.7.5 for more details.

Table 13. Vf History Data

Offset	Description	Length*	Default
0	Last Accessible Address Location	1	62
1	Checksum	1	1
2	Lock Byte	1	255
3	Minimum Vf, Hours at <VF_REFERENCE – 10	3	0
6	Minimum Vf, Hours at ≥VF_REFERENCE – 10 to <VF_REFERENCE – 8	3	0
9	Minimum Vf, Hours at ≥VF_REFERENCE – 8 to <VF_REFERENCE – 6	3	0
12	Minimum Vf, Hours at ≥VF_REFERENCE – 6 to <VF_REFERENCE – 4	3	0
15	Minimum Vf, Hours at ≥VF_REFERENCE – 4 to <VF_REFERENCE – 2	3	0
18	Minimum Vf, Hours at ≥VF_REFERENCE – 2 to <VF_REFERENCE	3	0
21	Minimum Vf, Hours at ≥VF_REFERENCE to <VF_REFERENCE +2	3	0
24	Minimum Vf, Hours at ≥VF_REFERENCE + 2 to <VF_REFERENCE + 4	3	0
27	Minimum Vf, Hours at ≥VF_REFERENCE + 4 to <VF_REFERENCE + 6	3	0
30	Minimum Vf, Hours at ≥VF_REFERENCE + 6	3	0
33	Maximum Vf, Hours at <VF_REFERENCE – 10	3	0
36	Maximum Vf, Hours at ≥VF_REFERENCE – 10 to <VF_REFERENCE – 8	3	0
39	Maximum Vf, Hours at ≥VF_REFERENCE – 8 to <VF_REFERENCE – 6	3	0
42	Maximum Vf, Hours at ≥VF_REFERENCE – 6 to <VF_REFERENCE – 4	3	0
45	Maximum Vf, Hours at ≥VF_REFERENCE – 4 to <VF_REFERENCE – 2	3	0
48	Maximum Vf, Hours at ≥VF_REFERENCE – 2 to <VF_REFERENCE	3	0
51	Maximum Vf, Hours at ≥VF_REFERENCE to <VF_REFERENCE +2	3	0
54	Maximum Vf, Hours at ≥VF_REFERENCE + 2 to <VF_REFERENCE + 4	3	0
57	Maximum Vf, Hours at ≥VF_REFERENCE + 4 to <VF_REFERENCE + 6	3	0
60	Maximum Vf, Hours at ≥VF_REFERENCE + 6	3	0

* For all multi-byte values (length >1), the first byte (lowest offset) contains the MSB

The maximum value that can be recorded in any bucket is 200,000, which corresponds to 200,000 hours (~23 years) of operation at that temperature.

3.6 Memory Bank 6: DALI Operation Type History

The XIM maintains a history of DALI operation types that are performed over each hour that the XIM is operating (i.e., VIN ≥ 40.0V) whether the LED is turned on or turned off (i.e., intensity = 0). This data can be used to build a histogram of the types of DALI operations performed by the XIM. Note that the data is persistent in the XIM, so the data read out from the XIM at any given point in time represents all historical DALI operation type data captured by the XIM to that point in time.

There are a total of four command type buckets that correspond to the following:

1. DALI Commands that require a response from the XIM (highest classification)
2. DALI Commands that do not require a response
3. No DALI commands received
4. DALI bus not present (lowest classification)

After each hour in which the XIM is operating elapses, the highest classification type of DALI command received during that hour is recorded and the corresponding command type bucket is incremented. Note that only one command type bucket will be incremented per hour, but there will always be at least one bucket incremented per hour that the XIM is operating.

Table 14. DALI Operation Type History Data

Offset	Description	Length*	Default
0	Last Accessible Address Location	1	14
1	Checksum	1	1
2	Lock Byte	1	255
3	Hours operating with DALI bus voltage not present	3	0
6	Hours operating with no DALI commands received	3	0
9	Hours operating with DALI commands that do not require a response	3	0
12	Hours operating with DALI commands that require a response	3	0

* For all multi-byte values (length >1), the first byte (lowest offset) contains the MSB

The maximum value that can be recorded in any bucket is 200,000, which corresponds to 200,000 hours (~23 years) of operation at that temperature.

3.7 Memory Bank 7: Operation History Data

In addition to the parameter specific history data captured by the XIM, there is additional general operation history data captured by the XIM on an hourly basis as well as other operational data that is captured on an event basis. Refer to Table 13. Vf History DataTable 15 for the operation history data captured by the XIM and the offset of each data value within the memory bank.

Table 15. Module History Data

Offset	Description	Length*	Default
0	Last Accessible Address Location	1	32
1	Checksum	1	1
2	Lock Byte	1	255
3	LED Operating hours	3	0
6	XIM power cycle count	3	0
9	LED power cycle count	3	0
12	Lifetime hours at under-voltage	3	0
15	Reference Vf	2	0
17	Reference Vf temperature	1	0
18	Maximum Vf	2	0
20	Maximum Vf capture time	3	0
23-32	Reserved	10	0

* For all multi-byte values (length >1), the first byte (lowest offset) contains the MSB

3.7.1 LED Operating Hours

The XIM maintains a record of the total number of hours that the LED has been operating at byte offset 3, with a total length of 3 bytes. The counter will be incremented for each hour that the LED is turned on and operating (i.e., intensity ≥ 0.1%). The maximum value for operating hours that can be recorded is 200,000, which corresponds to ~23 years of operation.

3.7.2 XIM Power Cycle Counter

When the XIM detects a power-on event, the XIM power cycle counter will be incremented. The XIM power cycle count is located at offset 6, with a total length of 3 bytes. The maximum value for XIM power cycles than can be recorded is 1,000,000.

3.7.3 LED Power Cycle Counter

When the LED is driven from off (intensity = 0) to on (intensity ≥ 0.1%), the LED power cycle counter will be incremented. Any LED off to on event, both power cycles and commanded intensity from off to on, will cause the LED power cycle to be incremented. The LED power cycle count is located at offset 9, with a total length of 3 bytes. The maximum value for LED power cycles than can be recorded is 1,000,000.

3.7.4 Time at Under-Voltage

The XIM maintains a record of the total number of hours that the XIM is operating in an under-voltage state (VIN > 30V and VIN ≤ 38V). The counter will be incremented for each hour that the XIM is operating in an under-voltage state and will store it at offset 12, with a total length of 3 bytes. The maximum value for time at under-voltage than can be recorded is 200,000.

3.7.5 Reference Vf Measurement and Temperature

The XIM will capture and store a reference LED Vf measurement the first time that the XIM is continuously operated for 5 minutes at an intensity ≥ 25% (DALI level 204 or above assuming the logarithmic dimming curve) with no operational faults detected. It will also store the operating temperature of the LED during the reference Vf measurement

The Vf reference value is two bytes long and is stored at byte offset 15. It represents the Vf value in mV (providing a value range of 0V to 65.535V). The temperature for the Vf reference value measurement is one byte long and is stored at byte offset 17. The temperature value represents the temperature in °C and it is range limited from -30°C to 125°C. The value is stored as a two's complement format, so positive temperatures from 0°C to 125°C will be read out as data values from 0 to 125 respectively, and negative temperatures from -30°C to -1°C will be read out as data values from 226 to 255 respectively (the negative temperature value = data value – 256).

3.7.6 Maximum Vf Measurement and Time

The XIM will capture and store the maximum LED Vf value captured during operation, and the time, in terms of operating hours, at which the measurement was captured. These values will be updated whenever a new maximum LED Vf value is detected. The Vf value is two bytes long and is stored at byte offset 18. It represents the Vf value in mV. The time value is three bytes long and is stored at byte offset 20. It represents the LED operating hours when the maximum Vf value was captured.

3.8 Memory Bank 8: Real-Time Data

The XIM provides real time operating/monitoring data for the multiple sensors integrated into the XIM in this memory bank. This data is not stored as history data on the module. It is simply a continuous real time reading of the sensors. Any storage or logging of this data needs to be performed outside the XIM.

Table 16. Real-Time Data

Offset	Description	Length*	Default
0	Last Accessible Address Location	1	14
1	Checksum	1	1
2	Lock Byte	1	255
3	Temperature of the XIM electronics	1	0
4	Temperature at the LED core (Tc)	1	0
5	Most Recent Vin (0 = 0.0, 60000 = 60.0)	2	0
7	Vin Ripple (0 = 0.0, 60000 = 60.0)	2	0
9	Average Vin (0 = 0.0, 60000 = 60.0)	2	0
11	Most Recent Vf (0 = 0.0, 60000 = 60.0)	2	0
13	LED Intensity (Including During Failure)	1	0
14	Bits [2:0] - Vf status Bits [4:3] - Vin status Bits [7:5] – Thermal status	1	0

* For all multi-byte values (length >1), the first byte (lowest offset) contains the MSB

3.8.1 Temperature Reporting

The XIM monitors both the LED core temperature (Tc point value) and the temperature of the electronics integrated in the XIM. The temperature value of the electronics is one byte at offset 3, and the temperature of the LED core is one byte at offset 4. The temperature value for each of these readings represents the temperature in °C and it is range limited from -30°C to 125°C. The value is stored in a two's complement format, so positive temperatures from 0°C to 125°C will be read out as data values from 0 to 125 respectively, and negative temperatures from -30°C to -1°C will be read out as data values from 226 to 255 respectively (negative temperature value = data value – 256).

3.8.2 Input Supply Voltage Reporting

The XIM monitors the input supply voltage (Vin) and reports it as a two byte value at byte offset 5. The Vin value is represented in mV (providing a value range of 0V to 65.535V).

The XIM calculates the peak-to-peak Vin ripple value by subtracting the minimum Vin value from the maximum Vin value captured over the last 100ms. Vin ripple is reported in mV as a two byte value at byte offset 7.

The XIM calculates an average Vin value based on the continuous operating Vin values. The Vin(average) value will start accumulating voltage values when Vin goes above the turn on voltage of 40V and remains above the turn off voltage of 30V for at least 400ms. The Vin(average) value is reported in mV as a two byte value at offset 9.

3.8.3 LED Forward Voltage (Vf) Reporting

In addition to capturing LED Vf history and maximum values, the XIM provides real time reporting of the LED Vf value. The Vf value is reported as a two byte value at byte offset 11. The Vf is represented in mV (providing a value range of 0V to 65.535V).

The Vf value is considered valid after the LED has been powered on at an intensity ≥ 25% with no operational faults detected.

3.8.4 LED Intensity

The LED intensity is reported as a single byte at offset 13. The value reported on this byte is the current DALI level that the LED is being driven at. Under normal operating conditions, the value reported in this byte matches the value reported when DALI command 160 (QUERY ACTUAL LEVEL) is executed. Under fault conditions, the intensity will continue to be reported in this byte, but the QUERY ACTUAL LEVEL command will return 255 to indicate a fault condition.

3.8.5 Diagnostic Status

The XIM reports device status as a single byte at offset 14. The value reported is separated into three bit mapped fields, with Vf status reported on bits [2:0], Vin status reported on bits [4:3] and Temperature status reported on bits [7:5].

Table 17. Vf Status Reporting

Status Value	Status	Description
000	Non-Valid	Indicates that a non-valid condition exists that prevents Vf from being measured. Non-valid conditions include operating at an LED Intensity <25% and Vin has not been >40V for at least 400ms.
001	Normal	Indicates that the currently sampled LED Vf value is within its normal operating range
010	Low	Indicates that the currently sampled Vf value is >5V below the LED Vf reference value
011	High	Indicates that the currently sampled Vf value is >5V above the LED Vf reference value
100	Short	Indicates that the XIM has detected an electrical short condition on the LED. This condition causes the LED intensity to be reduced to 0 (off), and it can only be cleared by power cycling the XIM. Note that if a Short condition is still detected after a power cycle, the XIM will re-enter this state.
101	Open	Indicates that the XIM has detected an electrical open condition on the LED.
110 – 111	Unused	These status values are reserved and not used by the XIM.

Table 18. Vin Status Reporting

Status Value	Status	Description
00	Non-Valid	Indicates that a power on event has been detected (Vin >40V), but less than 400ms has elapsed since the power on event.
01	Normal	Indicates that the average Vin has been >40V for over 400ms, and has not dropped below 38V (undervoltage threshold).
10	Undervoltage	Indicates that the average Vin is <38V, or a power on event was detected, but 400ms later the average Vin was <40V. When in this state, the LED intensity will be reduced to 0 (off).
11	Undervoltage Lockout	Indicates that the average Vin has gone above 40V and then dropped below 38V at least five times within a 10 minute period of time. This condition causes the LED intensity to be reduced to 0 (off), and it can be cleared by power cycling the XIM or by commanding the light intensity to 0 (off).

Table 19. Temperature Status Reporting

Status Value	Status	Description
000	Normal	Indicates that the LED is operating in its normal temperature range, and none of the fault conditions listed below exist.
001	Overload	Indicates that the LED temperature has gone to ≥93°C and has not dropped below the temperature restore point of 85°C. This condition is cleared when the LED temperature goes below 85°C and the commanded intensity level is restored. When this state is entered, the LED intensity will be reduced by 6 DALI levels (15% relative reduction) over a period of one minute, and the ACTUAL LEVEL reported will be 255 until this state is exited. When the temperature restore point is reached, the LED intensity will be increased to the commanded intensity over a period of one minute and the state will return to Normal.
010	Overload Latch	Indicates that the LED temperature has gone to ≥93°C, and has remained ≥93°C and <98°C for at least 10 minutes. This condition is cleared when the LED temperature is <93°C and either the intensity is commanded to 0 (off) or the module is power cycled. When this state is entered, the maximum allowed LED intensity is 10% (DALI level 170), and the ACTUAL LEVEL reported will be 255.
011	Cold Start	Indicates that the LED temperature has dropped below -20°C and has not gone above 0°C. This condition is cleared when the LED temperature goes above 0°C. When this state is entered, the maximum allowed LED intensity is 50% (DALI level 229). If the commanded intensity is below 50%, then being in this state will not alter light output. When the XIM is in this state, the ACTUAL LEVEL reported will be 255 until this state is exited. When this state is exited, the LED will be return to its commanded intensity (above 50%).
100	Shutdown	Indicates that the LED temperature has gone to ≥98°C. This condition is cleared when intensity is commanded to 0 (off), or the module is power cycled, and the LED temperature is <93°C. When this state is entered, the LED intensity will go to 0 (off), and the ACTUAL LEVEL reported will be 255.
101	Sensor Fail	Indicates that either the electronics or LED core temperature sensor has failed.
110 – 111	Unused	These status values are reserved and not used by the XIM.

4.0 DALI Variables

The XIM supports all of the DALI variables listed in section 10 of IEC 62386-102 and section 10 of IEC 62386-207. Listed in the table below are the default values for the variables defined as “factory burn-in” in the two specifications as well as the specification part number (-102 or -207) that defines the variable.

Table 20. Factory Burn-in DALI Variables

DALI Variable	Default Value	Spec Part
VERSION NUMBER	1	102
PHYSICAL MIN LEVEL	1	102
MIN FAST FADE TIME	12	207
GEAR TYPE	10	207
POSSIBLE OPERATING MODES	0	207
FEATURES	98	207

5.0 Supported DALI Commands

Listed in the table below are all of the DALI commands supported by the XIM as well as the DALI specification part number that should be referenced for further details on the command. The details for the address and data value associated with each command can be found in section 11 of the respective DALI specification part number (i.e., IEC 62386-102 or IEC62386-207).

Note the following with respect to the formatting in the table:

- **Bold type** indicates configuration commands that must be sent twice within 100ms in order to be executed.
- *Italic type* indicates application extended commands (i.e., part 207) that must be preceded by ENABLE DEVICE TYPE 6 (refer to command 272) in order to be executed.
- ***Bold italic type*** indicates application extended configuration commands that must be preceded by ENABLE DEVICE TYPE 6 and then sent twice within 100ms in order to be executed.

Table 21. Supported DALI Commands

Command Number	Command Name	Description	Spec Part
–	Direct Arc Power Control (X)	Fade light to DALI level X (uses Fade Time)	102
0	Off	Turn off the light immediately	102
1	Up	Fade light up for 200ms (uses Fade Rate)	102
2	Down	Fade light down for 200ms (uses Fade Rate)	102
3	Step Up	Increase light by 1 DALI level (can't turn on light)	102
4	Step Down	Decrease light by 1 DALI level (can't turn off light)	102
5	Recall Max Level	Set light to the maximum level	102
6	Recall Min Level	Set light to the minimum level	102
7	Step Down And Off	Decrease light by 1 DALI level (can turn off light)	102
8	On And Step Up	Increase light by 1 DALI level (can turn on light)	102
9	Enable DAPC Sequence	Enable dynamic fading	102

Command Number	Command Name	Description	Spec Part
16 - 31	Go To Scene X	Fade light to DALI level stored in scene X (uses Fade Time)	102
32	**Reset**	**Reset DALI configuration parameters**	**102**
33	**Store Actual Level In The DTR**	**Store the current DALI level in the DTR**	**102**
42	**Store The DTR As Max Level**	**Set the maximum level to the value in the DTR**	**102**
43	**Store The DTR As Min Level**	**Set the minimum level to the value in the DTR**	**102**
44	**Store The DTR As System Failure Level**	**Set the system failure level to the value in the DTR**	**102**
45	**Store The DTR As Power On Level**	**Set the power on level to the value in the DTR**	**102**
46	**Store The DTR As Fade Time**	**Set the fade time to the value in the DTR. See the fade time / fade rate table.**	**102**
47	**Store The DTR As Fade Rate**	**Set the fade rate to the value in the DTR. See the fade time / fade rate table.**	**102**
64 – 79	**Store The DTR As Scene X**	**Set the Scene X level to the value in the DTR**	**102**
80 – 95	**Remove From Scene X**	**Remove the Scene X level (set to 255)**	**102**
96 – 111	**Add To Group X**	**Add membership to group X**	**102**
112 – 127	**Remove From Group X**	**Remove membership from group X**	**102**
128	**Store DTR As Short Address**	**Set the short address to the value in the DTR**	**102**
129	**Enable Write Memory**	**Enable writes to the gear memory banks**	**102**
144	Query Status	Request status. Response is: bit 0: '0' = control gear is OK. '1' = over-temperature lockout, under-voltage, or memory error * bit 1: '0' = lamp is OK. '1' = lamp failure bit 2: '0' = lamp is off. '1' = lamp is on bit 3: '0' = last commanded light level is valid. '1' = invalid bit 4: '0' = fade is not running. '1' = fade is running bit 5: '0' = not in a reset state. '1' = in a reset state bit 6: '0' = has a short address. '1' = missing a short address bit 7: '0' = Reset or light level command received since lastpower-on. '1' = Not received	102
145	Query Control Gear	Request if control gear is present. Response is "Yes" or "No"	102
146	Query Lamp Failure	Request if lamp failure occurred. Response is "Yes" or "No"	207
147	Query Lamp Power On	Request if light is on. Response is "Yes" or "No"	102
148	Query Limit Error	Request if last commanded light level is valid. Response is "Yes" or "No"	102
149	Query Reset State	Request if in reset state. Response is "Yes" or "No"	102
150	Query Missing Short Address	Request if missing short address. Response is "Yes" or "No"	102
151	Query Version Number	Request DALI version number. Response is 1.	102
152	Query Content DTR	Request the DTR value	102

Command Number	Command Name	Description	Spec Part
153	Query Device Type	Request the device type. Response is 6 (LED)	207
154	Query Physical Minimum Level	Request the physical minimum level. Response is 1.	102
155	Query Power Failure	Request if a Reset or light level command received since last power-on. Response is "Yes" or "No"	102
156	Query Content DTR1	Request the DTR1 value	102
157	Query Content DTR2	Request the DTR2 value	102
160	Query Actual Level	Request the current light level. Answer is 0 - 254 if the light level is OK. Answer is 255 if there is an error.	102
161	Query Max Level	Request the maximum level	102
162	Query Min Level	Request the minimum level	102
163	Query Power On Level	Request the power on level	102
164	Query System Failure Level	Request the system failure level	102
165	Query Fade Time/Fade Rate	Request the fade time and fade rate. The response has the fade time in the upper 4 bits and the fade rate in the lower 4 bits. See the fade time / fade rate table.	102
176 – 191	Query Scene Level (Scenes 0-15)	Request the level of scene X	102
192	Query Groups 0-7	Request the membership of groups 0-7. Response shows membership in each bit. Bit x = group x membership. '1' = is a member. '0' = is not a member.	102
193	Query Groups 8-15	Request the membership of groups 8-15. Response shows membership in each bit. Bit x = group (x + 8) membership. '1' = is a member. '0' = is not a member.	102
194	Query Random Address (H)	Request the upper 8 bits of the random address	102
195	Query Random Address (M)	Request the middle 8 bits of the random address	102
196	Query Random Address (L)	Request the lower 8 bits of the random address	102
197	Read Memory Location	Request the value of the memory location at bank DTR1, offset DTR. If the location is valid, the response is the value. Also sets DTR2 to the value of the memory location at bank DTR1, offset (DTR + 1).	102
227	***Select Dimming Curve***	**Set the dimming curve. '0' = logarithmic. '1' = linear.**	**207**
228	***Store DTR As Fast Fade Time***	**Set the fast fade time to the value in the DTR. When fade time = 0, then fast fade time is used instead of fade time. See the fast fade time table.**	**207**
237	*Query Gear Type*	*Request the gear type. Response is 10 (LED module is integrated and DC supply is possible. LED power supply is not integrated and AC supply is not possible).*	*207*
238	*Query Dimming Curve*	*Request the dimming curve. Response is '0' = logarithmic, '1' = linear.*	*207*

Command Number	Command Name	Description	Spec Part
239	*Query Possible Operating Modes*	*Request the possible operating modes. Response is 0.*	*207*
240	*Query Features*	*Request the supported features. Response value is 98, with each bit set to '1' = feature supported and '0' = feature not supported* *bit 0: '0' = short circuit detection cannot be queried* *bit 1: '1' = open circuit detection can be queried* *bit 2: '0' = load decrease detection cannot be queried* *bit 3: '0' = load increase detection cannot be queried* *bit 4: '0' = current protector cannot be queried* *bit 5: '1' = thermal shut down can be queried* *bit 6: '1' = light level reduction due to thermal overload can be queried* *bit 7: '0' = physical selection is not supported*	*207*
241	*Query Failure Status*	*Request the failure status. Response for each bit is '1' = Yes and '0' = 'No'. The bit mapping is:* *bit 0: N/A* *bit 1: Open circuit detected* *bits 2 - 4: N/A* *bit 5: Thermal shut down* *bit 6: Thermal overload light reduction* *bit 7: N/A*	*207*
243	*Query Open Circuit*	*Request if an open circuit was detected. Response is "Yes" or "No"*	*207*
247	*Query Thermal Shut Down*	*Request if thermal shut down occurred. Response is "Yes" or "No"*	*207*
248	*Query Thermal Overload*	*Request if thermal overload light reduction occurred. Response is "Yes" or "No"*	*207*
252	*Query Operating Mode*	*Request the present operating mode. Response is 0.*	*207*
253	*Query Fast Fade Time*	*Request the fast fade time. See the fast fade time table.*	*207*
254	*Query Min Fast Fade Time*	*Request the minimum allowed fast fade time. See the fast fade time table.*	*207*
255	*Query Extended Version Number*	*Request the extended version number. Response is 1.*	*207*
256	Terminate	Terminate the special addressing process.	102
257	Data Transfer Register (DTR)	Set the DTR to X	102
258	**Initialise**	**Initialise the special addressing process.**	**102**
259	**Randomise**	**Generate a new random address**	**102**
260	Compare	Request if the random address is less than the search address. Response is "Yes" or "No"	102
261	Withdraw	Remove the device from the compare process if the random address equals the search address.	102
264	SearchAddrH	Set the upper 8 bits of the search address to X	102
265	SearchAddrM	Set the middle 8 bits of the search address to X	102
266	SearchAddrL	Set the lower 8 bits of the search address to X	102

Command Number	Command Name	Description	Spec Part
267	Program Short Address	Program the short address to Address if the random address equals the search address.	102
268	Verify Short Address	Request if the short address matches Address. Response is "Yes" or "No"	102
269	Query Short Address	Request the short address. If the random address equals the search address, the response is Address,1 or 255 (No address). If the random address does not equal the search address, then there is no response.	102
272	Enable Device Type 6	Select the LED device type so that the module will react to the application extended commands.	102
273	Data Transfer Register 1 (DTR1)	Set the DTR1 to X	102
274	Data Transfer Register 2 (DTR2)	Set the DTR2 to X	102
275	Write Memory Location	Writes X to the memory location at bank DTR1, offset DTR. If the location is valid (in memory bank table, is not read-only, and is unlocked), then the response is the value and the DTR is incremented. If the location is not valid, then there is no memory write and no response.	102