M.1 Overview

MODBUS protocol is an industrial communications and distributive control system developed by Gould-Modicon to integrate programmable logic controllers (PLCs), computers, terminals and other monitoring, sensing, and control devices. By setting a unique address via the address DIP switches, a LightMaster lighting controller can become a Slave NODE on the MODBUS Network. (See Figure M-1.)

M.2 Structure

MODBUS is a Master/Slave communications protocol. One device (the Master) controls all serial activity by selectively polling one or more of the slave devices. The maximum number of slave devices is 247 per network. Each device (node) is assigned a unique address to distinguish it from all the other nodes.

Only the Master initiates a transaction. Transactions are either a query/response (only a single slave is addressed), or a broadcast/no response (all slaves are addressed). A transaction comprises a single query and single response frame or a single broadcast frame.

Certain characteristics of the MODBUS protocol are fixed: frame format, frame sequences, communications error handling, exception conditions, and the functions performed. Other characteristics are selectable: transmission media, baud rate, character parity, number of stop bits, communications error handling, exception conditions, and functions performed.

M.3 Panel Level Connection

In applications where signal timing is critical, (Example: Theatrical Applications) a separate out cable is daisy-chained to each of the MODBUS device nodes. See Figure M.2

M.4 Single Point Gateway Connection

In applications where signal timing is less critical, a special MODBUS Gateway node may be installed on the network. This provides the advantage of eliminating the installation of dedicated cable runs and MODBUS modules to each controller. See Figure M.3

M.5 Transmission Modes

The transmission mode is the structure of the individual units of information within a message, and the numbering system used to transmit the data. Two transmission modes are available. Both provide the same communication capabilities. The mode slected depends on the equipment used as the MODBUS master. Only one transmission mode may be selected per network. Mixing modes on a single network is not allowed. The two available tranbsmission modes are ASCII (American Standard Code For Information Interchange) and RTU (Remote Terminal Unit)

M.5.1 ASCII

Coding System – ASCII (7 Bit); hexadecimal uses ASCII printable characters (0-9, A-F)
Start Bits – 1
Data Bits (least significant first) – 7
Parity (optional) – 1 (1 Bit set for even or odd, no Bits for no parity)
Stop Bits – 1 or 2
Error Checking – LRC (Longitudinal Redundancy Check)

M.5.2 RTU

Coding System – 8 Bit Binary
Start Bits – 1
Data Bits (least significant first) – 8
Parity (optional) – 1 (1 Bit set for even or odd, no Bits for no parity)
Stop Bits – 1 or 2
Error Checking – CRC (Cyclical Redundancy Check)

M.6 Transmission Mode Characteristics

ASCII printable characters are easy to view when trouble shooting and this mode is suited to PLC masters and computer masters programmed in a high level language, such as VISCOM BASIC.

In RTU mode, data is sent in 8-bit binary characters. In ASCII mode, data is divided into two 4 bit parts and then represented by the hexadecimal equivalent. ASCII mode uses twice as many characters as RTU mode but decoding is easier.

In RTU mode data must be transmitted in a continuous stream. In ASCII mode breaks of up to one second can occur between characters to allow for a relatively slow master.

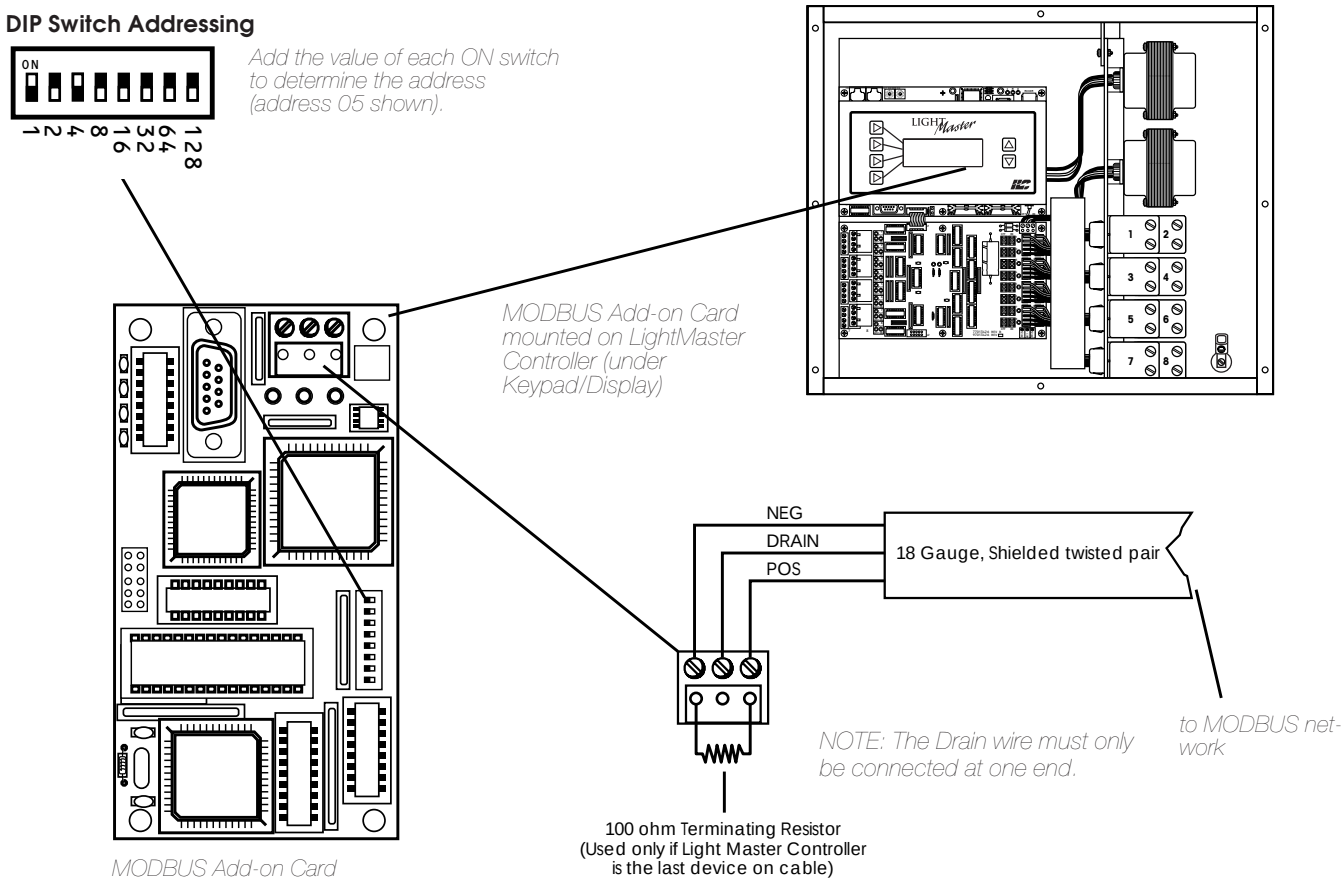


Figure M-1 MODBUS Set-Up

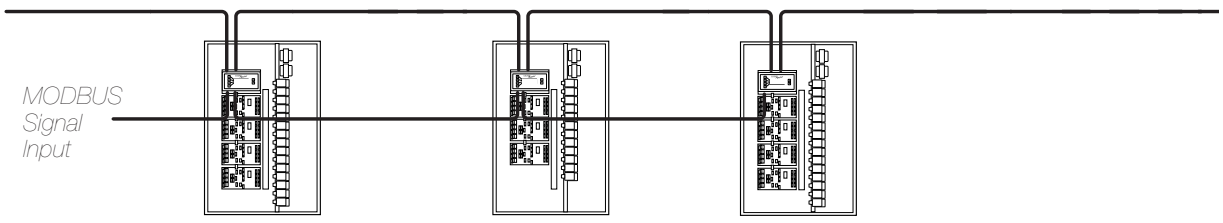
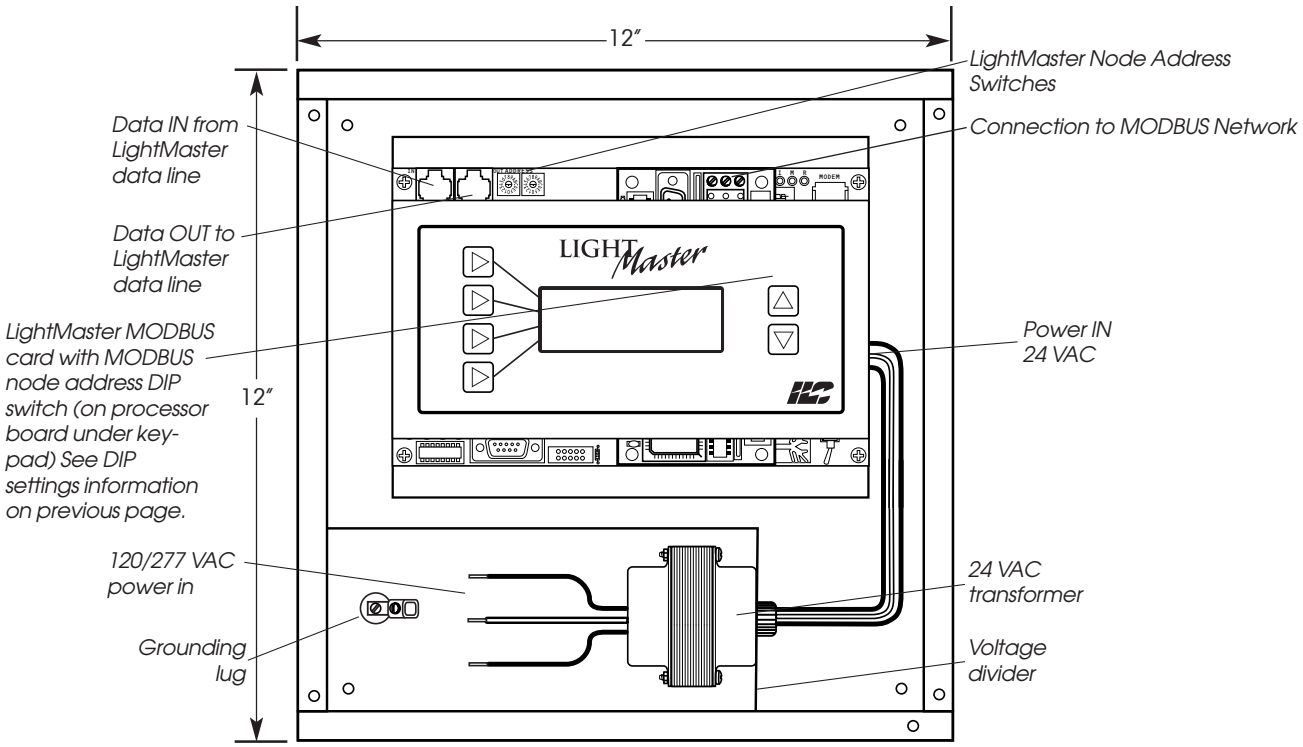


Figure M.2 – Panel ILevel MODBUS Connection



LightMaster MODBUS Gateway (shown in NEMA-type enclosure with transformer)

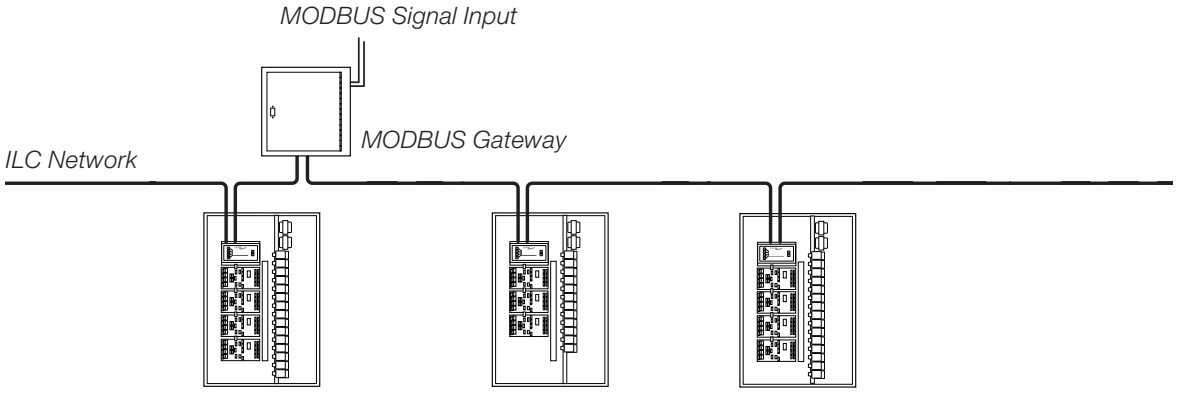


Figure M.3 – Gateway Level MODBUS Connection

M.7 Hardware Setup

The LightMaster must be equipped with a MODBUS add-on card and addressed with a unique node address (See Figure M-1). The network cable is a two wire shielded twisted pair. Consult the Automation system provider for the exact specifications. Terminate the cable as shown in Figure M.1.

M.8 Required Parameter Entries

After setting the MODBUS card address DIP switches, you must power up the LightMaster controller and define certain operational parameters for MODBUS communication. (See Fast Track diagram on next page.)

M.9 Framing

Both ASCII and RTU transmission modes feature mechanisms to indicate the beginning and end of a frame, the node address, a function code (the type of information sought/command signal), a data field indicating the particular point or register accessed. See Table M-1 for data field I/O point designators for a LightMaster node.

M.10 Supported Commands

01 Read coil status

02 Read input status

05 Force singe coil
15 Force multiple coils
For more information refer to Modicon Modbus Protocol Reference Guide (PI-MBUS-300)

M.11 Additional Functions

- ON/OFF with Time options (Blink/Alarm) See table M.1.2

M.12 Additional Information

Contact Modicon Inc. if you would like more detailed information on MODBUS protocol.

M.13 Programming

Panel Level Installation: From the software or from the Network Master's keypad, select the node containing the controller with the MODBUS module installed. From the EDIT NODE menu choice (software) or NODE STATUS (keypad), click on ADD ON MODULES. The MODBUS screen will appear. Select communications mode (ASCII or RTU), baud rate, and Parity from this screen. See Tables M.1, M.1.1, and M.1.2 for panel level point addresses.

Gatway Installation: From the Network Manager's keypad, press EDIT. Press NODE STATUS, then select the node number assigned to the MODBUS Gateway. Press EDIT, then press EDIT again. Select communications mode (ASCII or RTU), baud rate, and Parity.See Table M.1.3 for Gateway level point addresses.

NOTE: DMX Gateway may also be programmed using ILC LightMaster DMX Gateway configuration software.

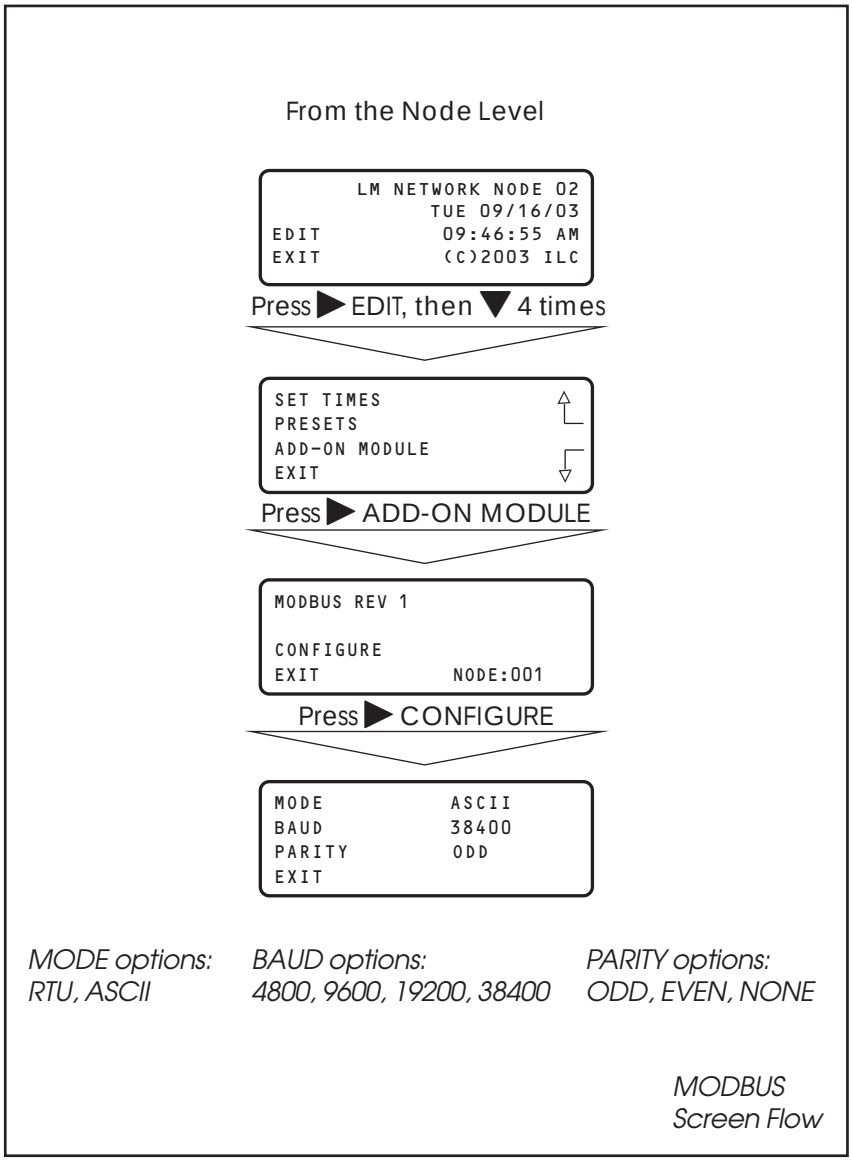
M.14 Gateway Point Address

The address is a four-digit Hex number. The upper two digits are the node number and the lower digits are the input,relay or group numbers. Example: Node 2D/Relay 23 is MODBUS number 2D17H. For commands 01 and 05, node FF controls groups. See table below and M1.3.

Hexadecimal Conversion Chart

No.	Hex	No.	Hex	No.	Hex	No.	Hex
0	00	12	0C	24	18	37	25
1	01	13	0D	25	19	38	26
2	02	14	0E	26	1A	39	27
3	03	15	0F	27	1B	40	28
4	04	16	10	28	1C	41	29
5	05	17	11	29	1D	42	2A
6	06	18	12	30	1E	43	2B
7	07	19	13	31	1F	44	2C
8	08	20	14	32	20	45	2D
9	09	21	15	34	22	46	2E
10	0A	22	16	35	23	47	2F
11	0B	23	17	36	24	48	30

MODBUS – Fast Track



MODBUS Screen Flow

LightMaster Input	ON	OFF	Closed	Open
1	1	49	1 = Input Closed	0= Input Open
2	2	50	1 = Input Closed	0= Input Open
3	3	51	1 = Input Closed	0= Input Open
4	4	52	1 = Input Closed	0= Input Open
5	5	53	1 = Input Closed	0= Input Open
6	6	54	1 = Input Closed	0= Input Open
7	7	55	1 = Input Closed	0= Input Open
8	8	56	1 = Input Closed	0= Input Open
9	9	57	1 = Input Closed	0= Input Open
10	10	58	1 = Input Closed	0= Input Open
11	11	59	1 = Input Closed	0= Input Open
12	12	60	1 = Input Closed	0= Input Open
13	13	61	1 = Input Closed	0= Input Open
14	14	62	1 = Input Closed	0= Input Open
15	15	63	1 = Input Closed	0= Input Open
16	16	64	1 = Input Closed	0= Input Open
17	17	65	1 = Input Closed	0= Input Open
18	18	66	1 = Input Closed	0= Input Open
19	19	67	1 = Input Closed	0= Input Open
20	20	68	1 = Input Closed	0= Input Open
21	21	69	1 = Input Closed	0= Input Open
22	22	70	1 = Input Closed	0= Input Open
23	23	71	1 = Input Closed	0= Input Open
24	24	72	1 = Input Closed	0= Input Open
25	25	73	1 = Input Closed	0= Input Open
26	26	74	1 = Input Closed	0= Input Open
27	27	75	1 = Input Closed	0= Input Open
28	28	76	1 = Input Closed	0= Input Open
29	29	77	1 = Input Closed	0= Input Open
30	30	78	1 = Input Closed	0= Input Open
31	31	79	1 = Input Closed	0= Input Open
32	32	80	1 = Input Closed	0= Input Open
33	33	81	1 = Input Closed	0= Input Open
34	34	82	1 = Input Closed	0= Input Open
35	35	83	1 = Input Closed	0= Input Open
36	36	84	1 = Input Closed	0= Input Open
37	37	85	1 = Input Closed	0= Input Open
38	38	86	1 = Input Closed	0= Input Open
39	39	87	1 = Input Closed	0= Input Open
40	40	88	1 = Input Closed	0= Input Open
41	41	89	1 = Input Closed	0= Input Open
42	42	90	1 = Input Closed	0= Input Open
43	43	91	1 = Input Closed	0= Input Open
44	44	92	1 = Input Closed	0= Input Open
45	45	93	1 = Input Closed	0= Input Open
46	46	94	1 = Input Closed	0= Input Open
47	47	95	1 = Input Closed	0= Input Open
48	48	96	1 = Input Closed	0= Input Open

Table M.1 – LightMaster Data Field Input Point Designators

LightMaster Output	Closed	Open
1	1=Output Closed	0=Output Open
2	1=Output Closed	0=Output Open
3	1=Output Closed	0=Output Open
4	1=Output Closed	0=Output Open
5	1=Output Closed	0=Output Open
6	1=Output Closed	0=Output Open
7	1=Output Closed	0=Output Open
8	1=Output Closed	0=Output Open
9	1=Output Closed	0=Output Open
10	1=Output Closed	0=Output Open
11	1=Output Closed	0=Output Open
12	1=Output Closed	0=Output Open
13	1=Output Closed	0=Output Open
14	1=Output Closed	0=Output Open
15	1=Output Closed	0=Output Open
16	1=Output Closed	0=Output Open
17	1=Output Closed	0=Output Open
18	1=Output Closed	0=Output Open
19	1=Output Closed	0=Output Open
20	1=Output Closed	0=Output Open
21	1=Output Closed	0=Output Open
22	1=Output Closed	0=Output Open
23	1=Output Closed	0=Output Open
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25	1=Output Closed	0=Output Open
26	1=Output Closed	0=Output Open
27	1=Output Closed	0=Output Open
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33	1=Output Closed	0=Output Open
34	1=Output Closed	0=Output Open
35	1=Output Closed	0=Output Open
36	1=Output Closed	0=Output Open
37	1=Output Closed	0=Output Open
38	1=Output Closed	0=Output Open
39	1=Output Closed	0=Output Open
40	1=Output Closed	0=Output Open
41	1=Output Closed	0=Output Open
42	1=Output Closed	0=Output Open
43	1=Output Closed	0=Output Open
44	1=Output Closed	0=Output Open
45	1=Output Closed	0=Output Open
46	1=Output Closed	0=Output Open
47	1=Output Closed	0=Output Open
48	1=Output Closed	0=Output Open

Table M.1.1 – LightMaster Data Field Output Point Designators

LightMaster Output	Coil Point	Closed	Open
1	101	1=Output Closed/Timer Option	0=Output Open/Timer Option
2	102	1=Output Closed/Timer Option	0=Output Open/Timer Option
3	103	1=Output Closed/Timer Option	0=Output Open/Timer Option
4	104	1=Output Closed/Timer Option	0=Output Open/Timer Option
5	105	1=Output Closed/Timer Option	0=Output Open/Timer Option
6	106	1=Output Closed/Timer Option	0=Output Open/Timer Option
7	107	1=Output Closed/Timer Option	0=Output Open/Timer Option
8	108	1=Output Closed/Timer Option	0=Output Open/Timer Option
9	109	1=Output Closed/Timer Option	0=Output Open/Timer Option
10	110	1=Output Closed/Timer Option	0=Output Open/Timer Option
11	111	1=Output Closed/Timer Option	0=Output Open/Timer Option
12	112	1=Output Closed/Timer Option	0=Output Open/Timer Option
13	113	1=Output Closed/Timer Option	0=Output Open/Timer Option
14	114	1=Output Closed/Timer Option	0=Output Open/Timer Option
15	115	1=Output Closed/Timer Option	0=Output Open/Timer Option
16	116	1=Output Closed/Timer Option	0=Output Open/Timer Option
17	117	1=Output Closed/Timer Option	0=Output Open/Timer Option
18	118	1=Output Closed/Timer Option	0=Output Open/Timer Option
19	119	1=Output Closed/Timer Option	0=Output Open/Timer Option
20	120	1=Output Closed/Timer Option	0=Output Open/Timer Option
21	121	1=Output Closed/Timer Option	0=Output Open/Timer Option
22	122	1=Output Closed/Timer Option	0=Output Open/Timer Option
23	123	1=Output Closed/Timer Option	0=Output Open/Timer Option
24	124	1=Output Closed/Timer Option	0=Output Open/Timer Option
25	125	1=Output Closed/Timer Option	0=Output Open/Timer Option
26	126	1=Output Closed/Timer Option	0=Output Open/Timer Option
27	127	1=Output Closed/Timer Option	0=Output Open/Timer Option
28	128	1=Output Closed/Timer Option	0=Output Open/Timer Option
29	129	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	130	1=Output Closed/Timer Option	0=Output Open/Timer Option
31	131	1=Output Closed/Timer Option	0=Output Open/Timer Option
32	132	1=Output Closed/Timer Option	0=Output Open/Timer Option
33	133	1=Output Closed/Timer Option	0=Output Open/Timer Option
34	134	1=Output Closed/Timer Option	0=Output Open/Timer Option
35	135	1=Output Closed/Timer Option	0=Output Open/Timer Option
36	136	1=Output Closed/Timer Option	0=Output Open/Timer Option
37	137	1=Output Closed/Timer Option	0=Output Open/Timer Option
38	138	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	139	1=Output Closed/Timer Option	0=Output Open/Timer Option
40	140	1=Output Closed/Timer Option	0=Output Open/Timer Option
41	141	1=Output Closed/Timer Option	0=Output Open/Timer Option
42	142	1=Output Closed/Timer Option	0=Output Open/Timer Option
43	143	1=Output Closed/Timer Option	0=Output Open/Timer Option
44	144	1=Output Closed/Timer Option	0=Output Open/Timer Option
45	145	1=Output Closed/Timer Option	0=Output Open/Timer Option
46	146	1=Output Closed/Timer Option	0=Output Open/Timer Option
47	147	1=Output Closed/Timer Option	0=Output Open/Timer Option
48	148	1=Output Closed/Timer Option	0=Output Open/Timer Option

Table M.1.2 – LightMaster with a Timer Option (Blink/Alarm) Output Point Designators

LightMaster Group	Point	Closed (True)	Open (False)
1	01	1=Group Closed	0=Group Open
2	02	1=Group Closed	0=Group Open
3	03	1=Group Closed	0=Group Open
4	04	1=Group Closed	0=Group Open
5	05	1=Group Closed	0=Group Open
6	06	1=Group Closed	0=Group Open
7	07	1=Group Closed	0=Group Open
8	08	1=Group Closed	0=Group Open
9	09	1=Group Closed	0=Group Open
10	0A	1=Group Closed	0=Group Open
11	0B	1=Group Closed	0=Group Open
12	0C	1=Group Closed	0=Group Open
13	0D	1=Group Closed	0=Group Open
14	0E	1=Group Closed	0=Group Open
15	0F	1=Group Closed	0=Group Open
16	10	1=Group Closed	0=Group Open
17	11	1=Group Closed	0=Group Open
18	12	1=Group Closed	0=Group Open
19	13	1=Group Closed	0=Group Open
20	14	1=Group Closed	0=Group Open
21	15	1=Group Closed	0=Group Open
22	16	1=Group Closed	0=Group Open
23	17	1=Group Closed	0=Group Open
24	18	1=Group Closed	0=Group Open
25	19	1=Group Closed	0=Group Open
26	1A	1=Group Closed	0=Group Open
27	1B	1=Group Closed	0=Group Open
28	1C	1=Group Closed	0=Group Open
29	1D	1=Group Closed	0=Group Open
30	1E	1=Group Closed	0=Group Open
31	1F	1=Group Closed	0=Group Open
32	20	1=Group Closed	0=Group Open
33	21	1=Group Closed	0=Group Open
34	22	1=Group Closed	0=Group Open
35	23	1=Group Closed	0=Group Open
36	24	1=Group Closed	0=Group Open
37	25	1=Group Closed	0=Group Open
38	26	1=Group Closed	0=Group Open
39	27	1=Group Closed	0=Group Open
40	28	1=Group Closed	0=Group Open
41	29	1=Group Closed	0=Group Open
42	2A	1=Group Closed	0=Group Open
43	2B	1=Group Closed	0=Group Open
44	2C	1=Group Closed	0=Group Open
45	2D	1=Group Closed	0=Group Open
46	2E	1=Group Closed	0=Group Open
47	2F	1=Group Closed	0=Group Open
48	30	1=Group Closed	0=Group Open

Table M.1.3 – Gateway Level LightMaster Data Field Group Point Designators (Node FF)