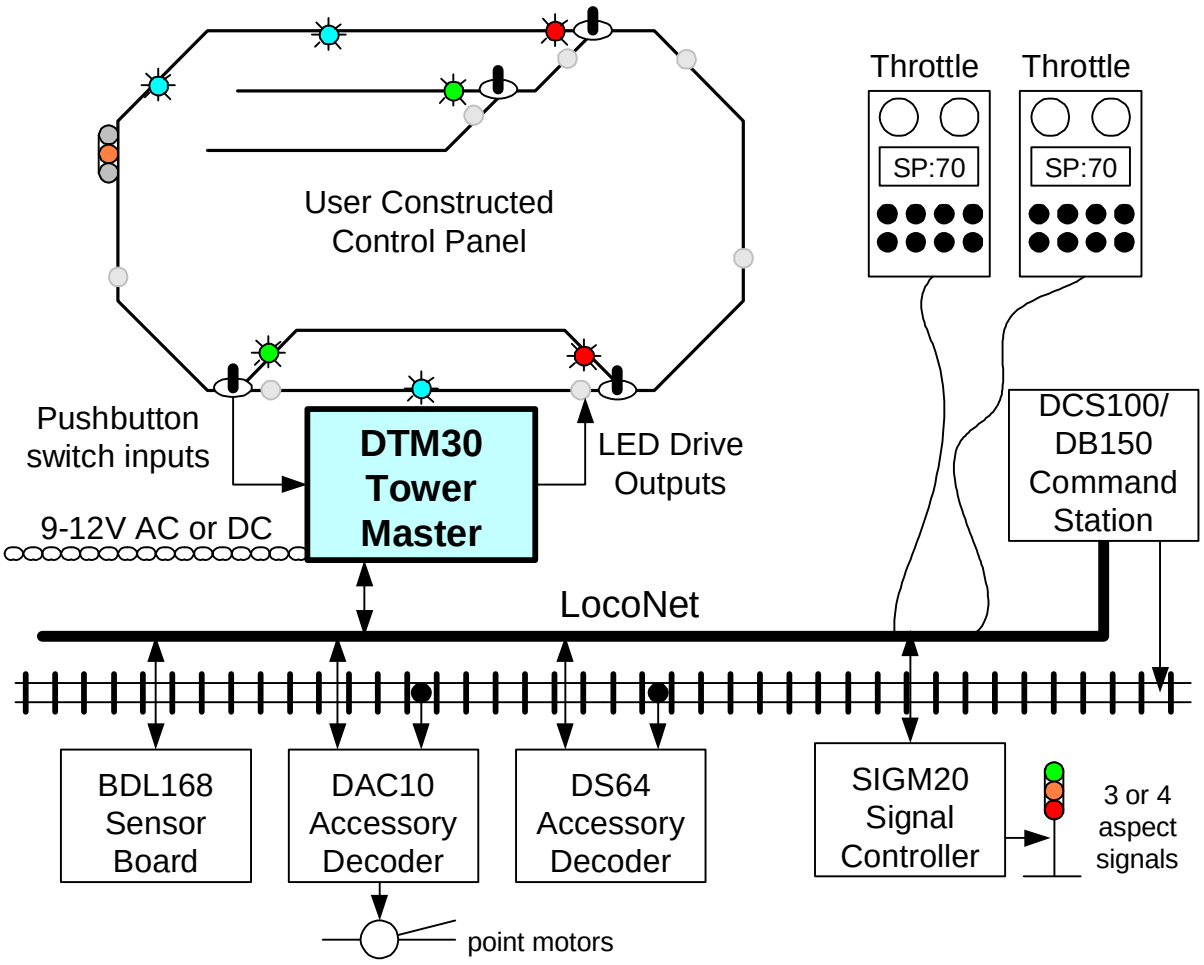
1 Introduction

The DTM30 Super Tower Master is an advanced controller to operate and display DCC accessories around a layout. It is designed to control and display points, track occupancy sensors & signals & can also control other DCC accessory devices.

The DTM30 Super Tower Master automates “layout control panels” and similar devices. It allows points, sensors and signals around the layout to be displayed with LEDs and controlled with pushbuttons. These interactions are all controlled through LocoNet®, the local area network supported by Digitrax and other DCC systems. This means that the control panel has minimal wiring associated with it – typically just power and LocoNet into the panel. Multiple panels can be used to control parts of the layout. The ability to control the accessory devices through handheld throttles, or using a PC, is not affected.

The DTM30 allows interoperability with PC control programs. This allows both computer and manual control of trackwork, while making sure accidents don’t occur. The operator can have full control, or control only when the PC says it is safe.



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2 Configuring the DTM30

In common with many DCC devices, the function performed by the DTM30 is fully defined by the settings of a number of System Variables (SVs). The functions can also be defined in the "normal" manner using a CV programmer. These parameters may be user programmed as described in this section. The settings define the following behaviour of the board. In most cases users will not need to program these settings directly. A PC program "locoanalyse" is available as a free download that allows the user to define the settings required and download them automatically into the board.

This manual has been provided for those that do wish to program the SVs manually, or who wish to understand more about the programming required. Please read this in conjunction with the board manual: this document does not describe the functions of the board itself.

2.1 SV Programming

2.1.1 PC Configuration

The "locoanalyse" PC configuration program is provided to determine the SV settings, and to download them into the board through LocoNet. This can be accomplished on a "live" operating layout. This is the recommended method of programming and requires the smallest degree of user effort. It also provides a method to store & document the settings for later reference.

2.1.2 Manual Programming

Manual programming of the System Variables can be accomplished using the programming facilities offered by all DCC command stations. Each system is different: the specific use of any one command station is not covered by this manual.

The SIGM10 supports **Direct Mode Programming in Service Mode** only. This means that:

- For programming, it must be connected to the command station's programming track output;
- SVs cannot be updated during normal operation of the layout.

1. Disconnect power from the board's power connector, SK1;
2. Remove any LocoNet connection;
3. Disconnect all LEDs and pushbuttons;
4. Insert jumpers JP1;
5. Connect SK1 to the programming track;
6. Select the command station to generate Direct Mode programming commands.

In this manual all register addresses and SV contents are listed in decimal format. If your throttle requires hexadecimal notation to describe the values to be programmed into each register, it will be necessary to convert the values to hex format. A decimal to hexadecimal conversion chart is provided in Appendix C.

SVs may be both programmed and read back. It may be necessary to repeat commands **quickly** if a "fail" message is received: this is because of the large storage capacitor on the board.

3 SV Definitions

SV number	Function	Values
1	EEPROM size	Readonly; =1
2	Software Version number	Readonly; value dependent on product version =0: beta release =1+: production release
3,4	Serial Number	2 SVs hold the board serial number, used for in-situ programming via LocoNet. Holds the value N for board N (i.e. board 17: SV3=17, SV4=0)
5	Route Mode	0: "normal" routes (12 addresses per route) 1: "to/from" routes (route responds to a from and to button number; 10 addresses per route)
6	Point Delay	0: no delay between point commands 1-255: extra delay between point outputs (e.g. for CDU recharge). Units ~0.1s
SV7	Device Id	Readonly; = 4 (identifies DTM30)
SV8	Manufacturer id	Readonly; = 1 (identified CML Electronics Limited)
9	"Slave" mode board address	1-255: defines a board number that sensor numbers are generated for. 0=board 256
10	"Slave" board address mode	0: reserves 4 addresses 1: reserves 1 board address; uses sensors 1-4 2: reserves 1 board address; uses sensors 5-8 3: reserves 1 board address; uses sensors 9-12 4: reserves 1 board address; uses sensors 13-16
11	Board mode at startup	0: "Standalone" mode 1: "Slave" mode 2: "Interlocked" mode
12, 13	External Route Activation	DCC address used to initiate routes from outside. Reserves a block of 25 addresses. 0 if unused. (addr 25 initialises all cells) (low byte first)
14, 15	"Slave" Address	DCC address to change board to "Slave" • Set to C: enters "Standalone" mode • Set to T: enters "Slave" mode
16, 17	"Interlocked" Address	DCC address to change board to "Interlocked" • Set to C: enters "Standalone" mode • Set to T: enters "Interlocked" mode
30-209	Cell Definitions (30 cells, each 6 CVs)	See section 3.1
210-245	Routes 1-3 (12 CVs per route)	See section 3.2
513-762	Routes 4-24 (12 CVs per route)	See section 3.2

3.1 Cell Definitions

SVs 30-210 define the capabilities of each cell: 6 SVs per cell. The meanings of these are defined here, with specific notes for each possible cell type:

Cell	SV Range	Cell	SV Range	Cell	SV Range
1	30-35	11	90-95	21	150-155
2	36-41	12	96-101	22	156-161
3	42-47	13	102-107	23	162-167
4	48-53	14	108-113	24	168-173
5	54-59	15	114-119	25	174-179
6	60-65	16	120-125	26	180-185
7	66-71	17	126-131	27	186-191
8	72-77	18	132-137	28	192-197
9	78-83	19	138-143	29	198-203
10	84-89	20	144-149	30	204-209

The meanings for each allowed cell type are described below. In each case the tables below refer to the start of the block of 6 SVs as X.

3.1.1 Point Cell

SV address	Function	Meaning
X	Cell type	1: Point cell assigned to Interlock 1 2: Point cell assigned to Interlock 2 3: Point cell assigned to Interlock 3 4: Point cell assigned to Interlock 4 5: Point cell not assigned to a Interlock
X + 1, X + 2	Address	1-2048: DCC cell address (see Appendix A for values for X+1 & X+2) Add 16 to the value for X+2 if the point state is to be determined using Turnout Feedback messages from the accessory decoder
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	Cascade value: 0: no cascade 1-30: cascade from cell 1–30, CLOSED side 31-60: cascade from cell 1–30, THROWN side Add Initialise setting: Cell doesn't initialise (add 0) Initialise point to Closed (add 64) Initialise point to Thrown (add 128)

3.1.2 Sensor Cell

SV address	Function	Meaning
X	Cell type	6: normal sensor cell
X + 1, X + 2	Address	X+1: board number (1-255; 0= board 256) X+2: sensor number (1-16) (see Appendix B)
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	0: LEDs off if state unknown 1: LEDs flash if state unknown

3.1.3 SIGM10 Signal Cell

SV address	Function	Meaning
X	Cell type	7: SIGM10 signal cell
X + 1, X + 2	Address	1-2048: DCC cell address (see Appendix A for values for X+1 & X+2)
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	Selects aspect display table

Aspect table values:

0	Bi-colour LED
1	Red, green LEDs
2	Amber, 2nd amber LEDs
3	Amber, rev running LEDs
4	Red, green LEDs; red flashes if forced red

3.1.4 SIGM10 Rev Run Zone Cell

SV address	Function	Meaning
X	Cell type	8: SIGM10 reverse running zone cell
X + 1, X + 2	Address	1-2048: zone DCC address (1st addr of the two) (see Appendix A for values for X+1 & X+2)
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	0: LEDs lit of state is locked. 1: LEDs flash if state is locked.

3.1.5 SE8c Signal Cell

SV address	Function	Meaning
X	Cell type	9: SE8c signal cell (SE8c opsw02=C; 1 addr) 10: SE8c signal cell (SE8c opsw02=T; 2 addr)
X + 1, X + 2	Address	1-2048: DCC cell address (1st address) (see Appendix A for values for X+1 & X+2)
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	Selects aspect display table

Appropriate aspect table values:

0	Bi-colour LED
1	Red, green LEDs
2	Amber, unused LEDs

3.1.6 Interlock Cell

SV address	Function	Meaning
X	Cell type	11: Interlock Cell
X + 1, X + 2	Address	1-2048: DCC switch address for the Interlock (used as handshake with RR&Co) (see Appendix A for values for X+1 & X+2)
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	Interlock number (1 to 4)

Interlock cell addresses are put into cells. If an Interlock is needed, it must have a cell assigned; even if it is requested from a different board.

3.1.7 "Copy" Cell

SV address	Function	Meaning
X	Cell type	12: "Copy" cell This cell takes its state info from another cell but may display differently.
X + 1, X + 2	Address	X+1: 1-30: defines a cell number that this cell follows X+2: not used
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	Selects option as per "parent" cell. Used to select different display aspect for signals, or different cascade for points

3.1.8 Display Board Mode Cell

SV address	Function	Meaning
X	Cell type	13: Board mode cell
X + 1, X + 2	Address	Not used.
X + 3	SW1 Function	See SW function table
X + 4	SW2 Function	See SW function table
X + 5	Option SV	Not used.

LEDs behave:
LEDA: lit if board is in "SLAVE" mode
LEDB: lit if board is in "INTERLOCKED" mode

3.1.9 Pushbutton Functions

Some switch functions are specific to a cell type. Others may be used in any cell (for example a route activation button can be in any cell).

SW Function Value	Function	Valid cell types
0	No Action	Any cell
1	Toggle point	Point Cell
2	Make point CLOSED	Point Cell
3	Make point THROWN	Point Cell
4	Make sensor toggle	Sensor Cell
5	Sensor active only when pushed	Sensor Cell
6	Request Interlock from RR&Co	Interlock Cell
7	Force signal to red	SIGM10 signal cell
8	Release signal for normal operation	SIGM10 signal cell
9	Set reverse running zone W-E	SIGM10 signal cell
10	Set reverse running zone E-W	SIGM10 signal cell
11	Set next aspect	SE8c signal cell
12	Initialise Points	Any Cell
13	Toggle Interlock mode	Any Cell
14	Toggle Slave mode	Any Cell
101-124	Execute route (N-100)	Any cell

3.2 Route Definitions

SVs 210-245, and 513-762 define the capabilities of routes 1-24. There are 12 SVs per route.

Route	SV Range	Route	SV Range	Route	SV Range
1	210-221	9	573-584	17	669-680
2	222-233	10	585-596	18	681-692
3	234-245	11	597-608	19	693-704
4	513-524	12	609-620	20	705-716
5	525-536	13	621-632	21	717-728
6	537-548	14	633-644	22	729-740
7	549-560	15	645-656	23	741-752
8	561-572	16	657-668	24	753-764

3.2.1 Route 1-24 Definitions

The meaning on the 12 CVs depend on the setting of the route mode SV (SV5).

3.2.1.1 "To/From" Mode

In this mode, routes are invoked by "to" and "From" buttons. This allows the user to program buttons that specify the start and end track. A route is selected if the "to" and "from" addresses match in either order.

SV address	Function	Meaning
X	"From" Address	Button number (1-60)
X + 1	"To" Address	Button number (1-60)
X + 2…X+11	Cell or point number	0: end of route 1-30: set point at cell 1-30 CLOSED 31-60: set point at cell 1-30 THROWN 61-94: cascade route number (N-60) after this route (this must be the last entry in the route) Additionally, points not controlled by cells on this board can be controlled. These need two entries per point. The A, B values are obtained "as normal" from Appendix A then programmed as follows: 1st entry, if point CLOSED: B+100 1st entry, if point THROWN: B+200 2nd entry = A value from Appendix A

3.2.1.2 "Normal" Mode

In this mode, routes are invoked by a single route button. This allows the user to have an additional two route addresses per cell.

SV address	Function	Meaning
X + 0…X+11	Cell or point number	0: end of route 1-30: set point at cell 1-30 CLOSED 31-60: set point at cell 1-30 THROWN 61-94: cascade route number (N-60) after this route (this must be the last entry in the route) Additionally, points not controlled by cells on this board can be controlled. These need two entries per point. The A, B values are obtained "as normal" from Appendix A then programmed as follows: 1st entry, if point CLOSED: B+100 1st entry, if point THROWN: B+200 2nd entry = A value from Appendix A

3.2.2 Route Mode (SV 5)

This value determines whether routes are called up by one button press, or by a pair of button presses.

- If SV5=0: “normal” routes (12 addresses per route)
- If SV5=1: “to/from” routes (route responds to a from and to button; 10 addresses per route)

3.2.3 External Route Activation (SV 12, 13)

These two SVs supply a DCC accessory address that can be used to trigger the routes externally (e.g. from a throttle). See Appendix A to find the numbers to program into the board.

A block of 24 DCC accessory addresses starting from this location are monitored; of set either to thrown or closed. The corresponding route number is activated.

3.3 Other SVs

3.3.1 Point Delay (SV6)

If this value is zero, then all point changes will be made immediately a cell or route button is pressed.

This can cause problems with some kinds of accessory decoder with Solenoid type point motors: this is because a capacitor discharge unit, if used, may need time to recharge before it is ready to trigger the next point motor. This CV allows a time delay to be inserted between each output request. If this value is non zero, then it specifies a time delay in approximate units of tenths of a second, between outputs.
Example: a value of 15 will lead to a 1.5 second delay between output requests.

3.3.2 Board Mode

3.3.2.1 Mode at Startup (SV11)

This specifies which of its 3 modes the board starts up in.

- 0: “Standalone” mode
- 1: “Slave” mode
- 2: “Interlocked” mode

3.3.2.2 DCC Address to enter Slave Mode (SV14, 15)

These SVs specify a DCC accessory address which can be used to change the board between “Standalone” and “Slave” mode. See Appendix A to find the numbers to program into the board.

- If these SVs are zero, then the mode cannot be changed
- If an address is programmed and it is set to CLOSED: the board enters “Standalone” mode
- If an address is programmed and it is set to THROWN: the board enters “Slave” mode

3.3.2.3 DCC Address to enter Interlocked Mode (SV16, 17)

These SVs specify a DCC accessory address which can be used to change the board between "Standalone" and "Interlocked" mode. See Appendix A to find the numbers to program into the board.

- If these SVs are zero, then the mode cannot be changed
- If an address is programmed and it is set to CLOSED: the board enters "Standalone" mode
- If an address is programmed and it is set to THROWN: the board enters "Interlocked" mode

3.3.2.4 Slave Mode Board Address (SV9)

This SV specifies a sensor board address for the sensor messages generated in some modes:

- In "Standalone" mode this SV is not used
- In "Interlocked" mode it specifies the sensor board address used for a sensor message for each of the 4 Interlock cells;
- Un "Slave" mode it specifies the first sensor board address used by the board. A total of 60 sensor messages, spanning 4 board addresses starting that this number, are used.

1-255: defines a board number that sensor numbers are generated for. Use value 0 for board 256

3.3.2.5 Board Address Mode (SV10)

Used in conjunction with the Slave mode Board Address for setting sensor messages generated

- In Stansalone mode:
  - Not used.
- In Slave mode:
  - Program to 0: reserves 4 board addresses
- In Interlocked mode:
  - 1: reserves 1 board address; uses sensors 1-4
  - 2: reserves 1 board address; uses sensors 5-8
  - 3: reserves 1 board address; uses sensors 9-12
  - 4: reserves 1 board address; uses sensors 13-16

Appendix A. Point Address Chart

Point addresses are defined using two SVs per point number. This appendix describes how to program the pairs of SVs to specify point addresses. Point addresses are the same as used on a handheld throttle to select each point. The user therefore "knows" what these values are. The point numbers need to be looked up in the following table to select a point address setting.

	2nd SV (B)							
1st SV (A)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	0	256	512	768	1024	1280	1536	1792
10	10	266	522	778	1034	1290	1546	1802
20	20	**276**	532	788	1044	1300	1556	1812
30	30	286	542	798	1054	1310	1566	1822
40	40	296	552	808	1064	1320	1576	1832
50	50	306	562	818	1074	1330	1586	1842
60	60	316	572	828	1084	1340	1596	1852
70	70	326	582	838	1094	1350	1606	1862
80	80	336	592	848	1104	1360	1616	1872
90	90	346	602	858	1114	1370	1626	1882
100	100	356	612	868	1124	1380	1636	1892
110	110	366	622	878	1134	1390	1646	1902
120	120	376	632	888	1144	1400	1656	1912
130	130	386	642	898	1154	1410	1666	1922
140	140	396	652	908	1164	1420	1676	1932
150	150	406	662	918	1174	1430	1686	1942
160	160	416	672	928	1184	1440	1696	1952
170	170	426	682	938	1194	1450	1706	1962
180	180	436	692	948	1204	1460	1716	1972
190	190	446	702	958	1214	1470	1726	1982
200	200	456	712	968	1224	1480	1736	1992
210	210	466	722	978	1234	1490	1746	2002
220	220	476	732	988	1244	1500	1756	2012
230	230	486	742	998	1254	1510	1766	2022
240	240	496	752	1008	1264	1520	1776	2032
250	250	506	762	1018	1274	1530	1786	2042

Table 1: Point Address Encoding

Increments of 10 are shown to keep the table size sensible. The exact value required is usually an intermediate value in between two table cells. To get intermediate point addresses, add the difference to the 1st SV value found from the table.

Example: to program point 279:

1. 1st & 2nd SV values of 20 & 1 respectively give a cell address of 276;

Where a point cell is to be monitored by Turnout feedback messages from the Accessory decoder, add 16 to the value of the second SV.

Appendix B. Sensor Address Selection

Sensor addresses have no natural "user" meaning. A convention has become established where sensor addresses are stored in an "X,Y" format. X is defined from the base address of the board and Y is determined from the sensor address within the board. X values range from 0 to 255; Y values range from 1 to 16. If you are unsure of the X and Y values to use, see the notes below.

For sensor cells, the X value is programmed into the 1st address location and the Y value into the second address location.

X, Y Values for BDL16

Users of some boards e.g. BDL16 will have programmed a board number "X" value directly into the board and no further information is needed. The Y value is determined directly by the channel number of the board. A value of 1 corresponds to the first channel; a value of 16 corresponds to the last channel.

X, Y Values for DS54

The board number "X" value will need to be determined from the board base address to which it was programmed. This appendix provides tables to allow the sensor address to be determined given knowledge of the board base address and the sensor connection to those boards.

The charts on the next two pages allow selection of the "X" value given the base address of the DS54. DS54 boards have only 8 sensors per board. Consequently two consecutive DS54 boards have the same X value: one occupies Y values 1-8 and the next occupies Y values 9-16. The "star" indicated in the table is used to decide which case is relevant.

DS54 input	Wire colour	Y value (no star after X value)	Y value (star after X value)
Aux Input 1	Orange	1	9
Main input 1	Blue	2	10
Aux Input 2	Black	3	11
Main input 2	Violet	4	12
Aux Input 3	Yellow	5	13
Main input 3	Grey	6	14
Aux Input 4	Green	7	15
Main input 4	Red	8	16

Example (cells highlighted in table overleaf): A DS54 has a programmed base address of 45. Its corresponding X value is therefore 6. The "Y" value will need to be selected from the column with a "star" in the table above.

X, Y Values for DAC10

X values for DAC10 boards are assigned in exactly the same way as for DS54 boards. Note that a DAC10 can be programmed to base addresses which "straddle" two X values. This happens where a "star" follows the X value and the Y value needs to be determined from the right hand column of the table below.

DAC10 input	Pin Numbers	Y value (no star after X value)	Y value (star after X value)
Main input 1	1, 2	2	10
Main input 2	3, 4	4	12
Main input 3	5, 6	6	14
Main input 4	7, 8	8	16
Main input 5	9, 10	10	2, add 1 to X
Main input 6	11, 12	12	4, add 1 to X
Main input 7	13, 14	14	6, add 1 to X
Main input 8	15, 16	16	8, add 1 to X
Aux input 1	17, 18	1	9
Aux input 2	19, 20	3	11

Base Addr	X	Base Addr	X	Base Addr	X	Base Addr	X	Base Addr	X	Base Addr	X
1	1	177	23	353	45	529	67	705	89	881	111
5	1*	181	23*	357	45*	533	67*	709	89*	885	111*
9	2	185	24	361	46	537	68	713	90	889	112
13	2*	189	24*	365	46*	541	68*	717	90*	893	112*
17	3	193	25	369	47	545	69	721	91	897	113
21	3*	197	25*	373	47*	549	69*	725	91*	901	113*
25	4	201	26	377	48	553	70	729	92	905	114
29	4*	205	26*	381	48*	557	70*	733	92*	909	114*
33	5	209	27	385	49	561	71	737	93	913	115
37	5*	213	27*	389	49*	565	71*	741	93*	917	115*
41	6	217	28	393	50	569	72	745	94	921	116
45	**6***	221	28*	397	50*	573	72*	749	94*	925	116*
49	7	225	29	401	51	577	73	753	95	929	117
53	7*	229	29*	405	51*	581	73*	757	95*	933	117*
57	8	233	30	409	52	585	74	761	96	937	118
61	8*	237	30*	413	52*	589	74*	765	96*	941	118*
65	9	241	31	417	53	593	75	769	97	945	119
69	9*	245	31*	421	53*	597	75*	773	97*	949	119*
73	10	249	32	425	54	601	76	777	98	953	120
77	10*	253	32*	429	54*	605	76*	781	98*	957	120*
81	11	257	33	433	55	609	77	785	99	961	121
85	11*	261	33*	437	55*	613	77*	789	99*	965	121*
89	12	265	34	441	56	617	78	793	100	969	122
93	12*	269	34*	445	56*	621	78*	797	100*	973	122*
97	13	273	35	449	57	625	79	801	101	977	123
101	13*	277	35*	453	57*	629	79*	805	101*	981	123*
105	14	281	36	457	58	633	80	809	102	985	124
109	14*	285	36*	461	58*	637	80*	813	102*	989	124*
113	15	289	37	465	59	641	81	817	103	993	125
117	15*	293	37*	469	59*	645	81*	821	103*	997	125*
121	16	297	38	473	60	649	82	825	104	1001	126
125	16*	301	38*	477	60*	653	82*	829	104*	1005	126*
129	17	305	39	481	61	657	83	833	105	1009	127
133	17*	309	39*	485	61*	661	83*	837	105*	1013	127*
137	18	313	40	489	62	665	84	841	106	1017	128
141	18*	317	40*	493	62*	669	84*	845	106*	1021	128*
145	19	321	41	497	63	673	85	849	107	1025	129
149	19*	325	41*	501	63*	677	85*	853	107*	1029	129*
153	20	329	42	505	64	681	86	857	108	1033	130
157	20*	333	42*	509	64*	685	86*	861	108*	1037	130*
161	21	337	43	513	65	689	87	865	109	1041	131
165	21*	341	43*	517	65*	693	87*	869	109*	1045	131*
169	22	345	44	521	66	697	88	873	110	1049	132
173	22*	349	44*	525	66*	701	88*	877	110*	1053	132*

Table 2: Sensor Base Addresses 1-1053

Base Addr	X	Base Addr	X	Base Addr	X	Base Addr	X	Base Addr	X	Base Addr	X
1057	133	1233	155	1409	177	1585	199	1761	221	1937	243
1061	133*	1237	155*	1413	177*	1589	199*	1765	221*	1941	243*
1065	134	1241	156	1417	178	1593	200	1769	222	1945	244
1069	134*	1245	156*	1421	178*	1597	200*	1773	222*	1949	244*
1073	135	1249	157	1425	179	1601	201	1777	223	1953	245
1077	135*	1253	157*	1429	179*	1605	201*	1781	223*	1957	245*
1081	136	1257	158	1433	180	1609	202	1785	224	1961	246
1085	136*	1261	158*	1437	180*	1613	202*	1789	224*	1965	246*
1089	137	1265	159	1441	181	1617	203	1793	225	1969	247
1093	137*	1269	159*	1445	181*	1621	203*	1797	225*	1973	247*
1097	138	1273	160	1449	182	1625	204	1801	226	1977	248
1101	138*	1277	160*	1453	182*	1629	204*	1805	226*	1981	248*
1105	139	1281	161	1457	183	1633	205	1809	227	1985	249
1109	139*	1285	161*	1461	183*	1637	205*	1813	227*	1989	249*
1113	140	1289	162	1465	184	1641	206	1817	228	1993	250
1117	140*	1293	162*	1469	184*	1645	206*	1821	228*	1997	250*
1121	141	1297	163	1473	185	1649	207	1825	229	2001	251
1125	141*	1301	163*	1477	185*	1653	207*	1829	229*	2005	251*
1129	142	1305	164	1481	186	1657	208	1833	230	2009	252
1133	142*	1309	164*	1485	186*	1661	208*	1837	230*	2013	252*
1137	143	1313	165	1489	187	1665	209	1841	231	2017	253
1141	143*	1317	165*	1493	187*	1669	209*	1845	231*	2021	253*
1145	144	1321	166	1497	188	1673	210	1849	232	2025	254
1149	144*	1325	166*	1501	188*	1677	210*	1853	232*	2029	254*
1153	145	1329	167	1505	189	1681	211	1857	233	2033	255
1157	145*	1333	167*	1509	189*	1685	211*	1861	233*	2037	255*
1161	146	1337	168	1513	190	1689	212	1865	234	2041	0
1165	146*	1341	168*	1517	190*	1693	212*	1869	234*	2045	0*
1169	147	1345	169	1521	191	1697	213	1873	235		
1173	147*	1349	169*	1525	191*	1701	213*	1877	235*		
1177	148	1353	170	1529	192	1705	214	1881	236		
1181	148*	1357	170*	1533	192*	1709	214*	1885	236*		
1185	149	1361	171	1537	193	1713	215	1889	237		
1189	149*	1365	171*	1541	193*	1717	215*	1893	237*		
1193	150	1369	172	1545	194	1721	216	1897	238		
1197	150*	1373	172*	1549	194*	1725	216*	1901	238*		
1201	151	1377	173	1553	195	1729	217	1905	239		
1205	151*	1381	173*	1557	195*	1733	217*	1909	239*		
1209	152	1385	174	1561	196	1737	218	1913	240		
1213	152*	1389	174*	1565	196*	1741	218*	1917	240*		
1217	153	1393	175	1569	197	1745	219	1921	241		
1221	153*	1397	175*	1573	197*	1749	219*	1925	241*		
1225	154	1401	176	1577	198	1753	220	1929	242		
1229	154*	1405	176*	1581	198*	1757	220*	1933	242*		

Table 3: Sensor Base Addresses 1057-2045

Appendix C. Hexadecimal Conversion Chart

All CV values in this manual are listed as decimal values. If your programming system requires hexadecimal values – for example Digitrax DT100 handheld throttles – use the following chart to convert.

dec	hex	dec	hex	dec	hex	dec	hex	dec	hex	dec	hex
0	00	44	2C	88	58	132	84	176	B0	220	DC
1	01	45	2D	89	59	133	85	177	B1	221	DD
2	02	46	2E	90	5A	134	86	178	B2	222	DE
3	03	47	2F	91	5B	135	87	179	B3	223	DF
4	04	48	30	92	5C	136	88	180	B4	224	E0
5	05	49	31	93	5D	137	89	181	B5	225	E1
6	06	50	32	94	5E	138	8A	182	B6	226	E2
7	07	51	33	95	5F	139	8B	183	B7	227	E3
8	08	52	34	96	60	140	8C	184	B8	228	E4
9	09	53	35	97	61	141	8D	185	B9	229	E5
10	0A	54	36	98	62	142	8E	186	BA	230	E6
11	0B	55	37	99	63	143	8F	187	BB	231	E7
12	0C	56	38	100	64	144	90	188	BC	232	E8
13	0D	57	39	101	65	145	91	189	BD	233	E9
14	0E	58	3A	102	66	146	92	190	BE	234	EA
15	0F	59	3B	103	67	147	93	191	BF	235	EB
16	10	60	3C	104	68	148	94	192	C0	236	EC
17	11	61	3D	105	69	149	95	193	C1	237	ED
18	12	62	3E	106	6A	150	96	194	C2	238	EE
19	13	63	3F	107	6B	151	97	195	C3	239	EF
20	14	64	40	108	6C	152	98	196	C4	240	F0
21	15	65	41	109	6D	153	99	197	C5	241	F1
22	16	66	42	110	6E	154	9A	198	C6	242	F2
23	17	67	43	111	6F	155	9B	199	C7	243	F3
24	18	68	44	112	70	156	9C	200	C8	244	F4
25	19	69	45	113	71	157	9D	201	C9	245	F5
26	1A	70	46	114	72	158	9E	202	CA	246	F6
27	1B	71	47	115	73	159	9F	203	CB	247	F7
28	1C	72	48	116	74	160	A0	204	CC	248	F8
29	1D	73	49	117	75	161	A1	205	CD	249	F9
30	1E	74	4A	118	76	162	A2	206	CE	250	FA
31	1F	75	4B	119	77	163	A3	207	CF	251	FB
32	20	76	4C	120	78	164	A4	208	D0	252	FC
33	21	77	4D	121	79	165	A5	209	D1	253	FD
34	22	78	4E	122	7A	166	A6	210	D2	254	FE
35	23	79	4F	123	7B	167	A7	211	D3	255	FF
36	24	80	50	124	7C	168	A8	212	D4		
37	25	81	51	125	7D	169	A9	213	D5		
38	26	82	52	126	7E	170	AA	214	D6		
39	27	83	53	127	7F	171	AB	215	D7		
40	28	84	54	128	80	172	AC	216	D8		
41	29	85	55	129	81	173	AD	217	D9		
42	2A	86	56	130	82	174	AE	218	DA		
43	2B	87	57	131	83	175	AF	219	DB		