

High End **Product Update**



S Y S T E M S ®

Date: March 16, 1998

Product Line:	<i>Technobeam/Technopro/Technoray</i>
Assembly:	<i>Technobeam User Manual, all versions</i>
Subject:	Technobeam, Technoray, Technopro DMX protocols

The information in this product update supersedes the DMX protocol information in Appendix A of the *Technobeam User Manual*.

Channel Boundaries

The DMX 512 protocol provides 512 channels that are divided among all the devices connected to the controller in a particular link. The number of channels that a device uses depends on the requirements and design of the device. In theory, you could have one device that uses 512 channels, two devices that each use 256 channels, four devices that each use 128 channels, up to 512 devices that use one channel each.

Each Technobeam, Technopro or Technoray fixture uses a contiguous block of channels with each block having a unique starting channel. The block of channels assigned to each fixture defines its *channel boundary*. Channel boundaries can start at any channel, even or odd. The exact starting channel depends on the fixture's method of control.

For example, Technopro is on a 12-channel boundary. That means a Technopro fixture set to DMX start channel 1 uses channels 1—11.

Non-Overlapping Boundaries

No two devices on the same DMX link can have overlapping boundaries. In other words, you must reserve for each device the entire range of DMX channels required for that device (for example, 12 channels must be reserved for each Technopro). If boundaries overlap, one or both devices will be disabled or will behave erratically.

The single exception to the non-overlapping rule is if you want two devices to respond to control commands in exactly the same way; in that case, both devices would share an entire DMX channel range.

General Information

The information in this section applies to all of the protocols listed in this Appendix (except where noted).

Rounding Conventions

The values displayed in the columns “Value (dec.)”, “Value (%)” and “Value (hex)” in the following tables may vary slightly depending on your controller’s rounding convention.

16-Bit Control

The full protocols for Technobeam and Technoray give you 16-bit control over the positioning of the mirror (Technobeam only) and the angular position of rotating lithos. However, you always have smooth, 16-bit control over *movement*, even if you choose the reduced protocol—which gives you 8-bit control over mirror and litho positioning.

The full protocols give you two channels of position control: one channel sets the *most significant* 8 bits (*coarse adjustment*), while the second channel sets the *least significant* 8 bits (*fine adjustment*) of a 16-bit value. The high order bit gives you 256 times the number of litho position stops (65,536 for 16-bit compared to 256 for 8-bit).

Macros

Technobeam full protocol, Technoray full protocol and Technpro protocol offer 28 selectable macros to simplify programming. A *macro* is a set of preconfigured constructs you can use with any other combination of constructs you want, except Laser Aiming Device constructs. Because the Technobeam Laser Aiming Device shares the same DMX channel, you cannot use both macros and the Laser Aiming Device at the same time.

MSpeed vs. Fast Changes

There are two different ways you can choose to move the color and litho wheels: fast changes or MSpeed changes.

A *fast* change means the color or litho movement is completed in the shortest amount of time after the wheel starts moving.

An *MSpeed* (motor/mirror speed) change occurs smoothly over the entire MSpeed time value. For example, if you choose a numerical DMX value of 202 for an MSpeed color change from position 2 to position 4, that means the color wheel changes gradually to position 4 over 11.41 seconds. (Most controllers also allow you to program advanced features, like crossfade or delay time. Make sure your MSpeed value is at least as long as the crossfade or delay time; otherwise, the color or litho change will not complete before the next page or scene starts.)

MSpeed time values are shown in Table 4 on page 15.

Ramp Open, Snap Shut

The Shutter construct includes parameters named “Ramp open, snap shut” and “Snap open, ramp shut”. A *snap* is an instant shutter movement (opening or closing); the snap time never varies. What you can vary is the timing of the *ramp*, which is a gradual shutter movement. A lower value always means a longer ramp, and a higher value always means a shorter ramp.

Forward and Reverse Spins

A *forward* spin on all wheels and positions means the wheel or position spins clockwise as you’re looking at the projected image. A *reverse* spin means the wheel or position spins counter-clockwise.

Technobeam™ Protocol

Table 1 gives the DMX channel assignments for the Technobeam full 18-channel protocol and reduced 14-channel protocol. The column “Ch. (F)” lists channel assignments for the full protocol and the column “Ch. (R)” lists channel assignments for the reduced protocol.

Table 1. Technobeam DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
1	1	Pan (mirror) position	Coarse adjustment	0 - 255	0 - 100	00h - FFh
2	n/a	Pan (mirror) position	Fine adjustment	0 - 255	0 - 100	00h - FFh
3	2	Tilt (mirror) position	Coarse adjustment	0 - 255	0 - 100	00h - FFh
4	n/a	Tilt (mirror) position	Fine adjustment	0 - 255	0 - 100	00h - FFh
5	3	Color wheel functions Fast color change (at beginning of wheel movement) Select the function with this channel. Then use ch. 6 (F) or 4 (R) to set the position or spin speed.	Indexed (wheel snaps to center of aperture)	0 - 15	0 - 5	00h - 0Fh
			Forward spin	16 - 31	6 - 12	10h - 1Fh
			Reverse spin	32 - 47	13 - 18	20h - 2Fh
			Continuous	48 - 63	19 - 24	30h - 3Fh
			Slow scan	64 - 79	25 - 30	40h - 4Fh
			Fast scan	80 - 95	31 - 37	50h - 5Fh
			Random	96 - 111	38 - 43	60h - 6Fh
			Blink (same as index, except shutter closes between apertures)	112 - 127	44 - 49	70h - 7Fh
		Color changes set by MSpeed (use ch. 16 (F) or 13 (R) to set MSpeed time). Select the parameter with this channel. Then use ch. 6 (F) or 4 (R) to set the position or spin speed.	Indexed (wheel snaps to center of aperture)	128 - 143	50 - 56	80h - 8Fh
			Forward spin	144 - 159	57 - 62	90h - 9Fh
			Reverse spin	160 - 175	63 - 68	A0h - AFh
			Continuous	176 - 191	69 - 74	B0h - BFh
			Slow scan	192 - 207	75 - 81	C0h - CFh
			Fast scan	208 - 223	82 - 87	D0h - DFh
			Random	224 - 239	88 - 93	E0h - EFh
			Blink (same as index, except shutter closes between apertures)	240 - 255	94 - 100	F0h - FFh
6	4	Color wheel position and functions Position (aperture) selection for blink or index mode (use with ch. 5 (F) or 3 (R))	Position 1 (open)	0 - 23 248 - 255	0 - 9 97 - 100	00h - 17h F8h - FFh
			Position 2	24 - 31	9 - 12	18h - 1Fh
			Position 3	32 - 39	13 - 15	20h - 27h
			Position 4	40 - 47	16 - 18	28h - 2Fh
			Position 5	48 - 55	19 - 22	30h - 37h
			Position 6	56 - 63	22 - 24	38h - 3Fh
			Position 7	64 - 71	25 - 27	40h - 47h
			Position 8	72 - 79	28 - 30	48h - 4Fh
			Position 9	80 - 87	31 - 34	50h - 57h
			Position 10	88 - 95	35 - 37	58h - 5Fh
			Position 11	96 - 103	38 - 40	60h - 67h
			Position 12	104 - 111	41 - 43	68h - 6Fh
			Position 13	112 - 127	44 - 49	70h - 7Fh
			Half color 1 and 2	128 - 143	50 - 56	80h - 8Fh

Table 1. Technobeam DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
			Half color 2 and 3	144 - 151	57 - 59	90h - 97h
			Half color 3 and 4	152 - 159	60 - 62	98h - 9Fh
			Half color 4 and 5	160 - 167	63 - 65	A0h - A7h
			Half color 5 and 6	168 - 175	66 - 68	A8h - AFh
			Half color 6 and 7	176 - 183	69 - 71	B0h - B7h
			Half color 7 and 8	184 - 191	72 - 74	B8h - BFh
			Half color 8 and 9	192 - 199	75 - 78	C0h - C7h
			Half color 9 and 10	200 - 207	79 - 81	C8h - CFh
			Half color 10 and 11	208 - 215	82 - 84	D0h - D7h
			Half color 11 and 12	216 - 223	85 - 87	D8h - DFh
			Half color 12 and 13	224 - 231	88 - 90	E0h - E7h
			Half color 13 and 1	232 - 247	91 - 96	E8h - F7h
			Color wheel continuous forward/reverse spin (use with ch. 5 (F) or 3 (R))	No spin	0 - 3	0 - 1
		Slowest spin to fastest spin		4 - 255	2 - 100	04h - FFh
		Color wheel continuous variation (wheel position is 360 * (channel dec. value / 255) Use with ch. 5 (F) or 3 (R)	Centered on position 1 (open)	0 255	0 100	00h FFh
			Centered on position 2	19	7	13h
			Centered on position 3	39	15	27h
			Centered on position 4	58	23	3Ah
			Centered on position 5	78	31	4Eh
			Centered on position 6	98	38	62h
			Centered on position 7	117	46	75h
			Centered on position 8	137	54	89h
			Centered on position 9	156	61	9Ch
			Centered on position 10	176	69	B0h
			Centered on position 11	196	77	C4h
			Centered on position 12	215	84	D7h
Centered on position 13	235		92	EBh		
7	5	Litho wheel functions Fast litho changes (at beginning of wheel movement) Select the function with this channel. Then use chs. 8, 9 & 10 (F) or chs. 6 & 7 (R) to set other options. Random and scan pause time set by chs. 9 & 10 (F) or ch. 7 (R)	Indexed (wheel snaps to center of aperture)	0 - 15	0 - 5	00h - 0Fh
			Forward spin	16 - 31	6 - 12	10h - 1Fh
			Reverse spin	32 - 47	13 - 18	20h - 2Fh
			Scan	48 - 63	19 - 24	30h - 3Fh
			Blink (same as index, except shutter closes between apertures)	64 - 79	25 - 30	40h - 4Fh
			Random	80 - 95	31 - 37	50h - 5Fh
			Reserved	96 - 111	38 - 43	60h - 6Fh
			Wheel spin	112 - 127	44 - 49	70h - 7Fh

Table 1. Technobeam DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)	
		<p>Litho changes set by MSPEED (use ch. 16 (F) or 13 (R) to set MSPEED time)</p> <p>Select the parameter with this channel. Then use chs. 8, 9 & 10 (F) or chs. 6 & 7 (R) to set other options.</p> <p>Random and scan pause time set by ch. 9 (F) or ch. 7 (R)</p>	Indexed (wheel snaps to center of aperture)	128 - 143	50 - 56	80h - 8Fh	
			Forward spin	144 - 159	57 - 62	90h - 9Fh	
			Reverse spin	160 - 175	63 - 68	A0h - AFh	
			Scan	176 - 191	69 - 74	B0h - BFh	
			Blink (same as index, except shutter closes between apertures)	192 - 207	75 - 81	C0h - CFh	
			Random	208 - 223	82 - 87	D0h - DFh	
			Reserved	224 - 239	88 - 93	E0h - EFh	
			Wheel spin	240 - 255	94 - 100	F0h - FFh	
8	6	<p>Litho wheel position</p> <p>Position (aperture) selection for blink or index mode (use with ch. 5 (F) or 3 (R))</p>	Position 1 (open)	0 - 15 240 - 255	0 - 5 94 - 100	00h - 0Fh F0h - FFh	
			Position 2	16 - 47	6 - 18	10h - 2Fh	
			Position 3	48 - 79	19 - 30	30h - 4Fh	
			Position 4	80 - 111	31 - 43	50h - 6Fh	
			Position 5	112 - 143	44 - 56	70h - 8Fh	
			Position 6	144 - 175	57 - 68	90h - AFh	
			Position 7	176 - 207	69 - 81	B0h - CFh	
			Position 8	208 - 239	82 - 93	D0h - EFh	
9	7	<p>Litho rotation (coarse adjustment) and functions</p>	Angular position for blink and index modes	0 - 255	0 - 100	00h - FFh	
			Random	Random pause time, shortest to longest	0 - 255	0 - 100	00h - FFh
			Scan	Scan rate, slowest to fastest	0 - 255	0 - 100	00h - FFh
			Litho wheel spin (use with ch. 7 (F) or ch. 5 (R))	Forward spin, fastest to slowest	0 - 119	0 - 47	0 - 77h
				No spin	120 - 135	47 - 53	78h - 87h
				Reverse spin, slowest to fastest	136 - 255	53 - 100	88h - FFh
Entire wheel spins, not individual lithos							
10	n/a	Litho rotation (fine adjustment)	Angular position for blink and index modes	0 - 255	0 - 100	00h - FFh	
11	8	<p>Effects position</p> <p>Fast effects changes (at beginning of wheel movement)</p> <p>Select the position with this channel. Then use ch. 12 (F) or ch. 9 (R) to set spin direction and speed.</p>	Position 1	0 - 25	0 - 9	00h - 19h	
			Position 2	26 - 51	10 - 20	1Ah - 33h	
			Position 3	52 - 76	21 - 29	34h - 4Ch	
			Position 4	77 - 102	31 - 40	4Dh - 66h	
			Position 5	103 - 127	41 - 49	67h - 7Fh	
		<p>Effects changes set by MSPEED (use ch. 16 (F) or 13 (R) to set MSPEED time)</p> <p>Select the position with this channel. Then use ch. 12 (F) or ch. 9 (R) to set spin direction and speed</p>	Position 1	128 - 153	50 - 60	80h - 99h	

Table 1. Technobeam DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
			Position 2	154 - 178	61 - 69	9Ah - B2h
			Position 3	179 - 204	70 - 80	B2h - CCh
			Position 4	205 - 229	81 - 89	CDh - E5h
			Position 5	230 - 255	90 - 100	E6h - FFh
12	9	Effects spin speed (use with ch. 11 (F) or ch. 8 (R))	Forward spin fast to slow forward spin	0 - 120	0 - 47	00h - 78h
			No spin	121 - 134	48 - 52	79h - 86h
			Reverse spin slow to fast forward spin	135 - 255	53 - 100	87h - FFh
13	10	Focus	Variable focus	0 - 255	0 - 100	00h - FFh
14	11	Shutter Longest ramp time = lowest value (snap time is always short)	Closed	0 - 7	0 - 2	00h - 07h
			Periodic strobe	8 - 67	3 - 26	08h - 43h
			Random strobe	68 - 127	27 - 49	44h - 7Fh
			Ramp open, snap shut	128 - 187	50 - 73	80h - BBh
			Snap open, ramp shut	188 - 247	74 - 96	BCh - F7h
			Open	248 - 255	97 - 100	F8h - FFh
15	12	Dim	Full dark to full bright	0 - 255	0 - 100	00h - FFh
16	13	MSpeed	Movement time (see Table 4 on page 15)			
17	n/a	Laser Aiming Device (LAD)	LAD off	0 - 7 120 - 127	0 - 3 47 - 49	00 - 07h 78h - 7Fh
			LAD modulate slow to fast ¹	128 - 247	50 - 96	80h - F7h
			LAD on (continuous)	248 - 255	97 - 100	F8h - FFh
		Macros	Macro 1—28 (see Table 5 on page 19)			
18	14	Control²	Safe ³	0 - 7	0 - 3	00h - 07h
			Display off	24 - 26	9 - 10	18h - 1Ah
			Display dim	32 - 34	13	20h - 22h
			Display bright	40 - 42	16	28h - 2Ah
			Home ⁴	64 - 66	25 - 26	40h - 42h
			Lamp on ⁵	80 - 82	31 - 32	50h - 52h
			Lamp off ⁶	96 - 98	38	60h - 62h
			Shutdown	128 - 130	50 - 51	80h - 82h

¹ - “Slow” modulation is 4.25 times/sec and “fast” modulation is 255 times/sec, at 50% duty cycle.

² - You must set the Shutter channel to zero before accessing the Control channel.

³ - When set to Safe, the control channel has no effect if the shutter is closed.

⁴ - Hold the Control channel at this value for at least one second. Homing the fixture in this way does not change the state of the lamp (if the lamp was off, it stays off; if the lamp was on, it stays on).

⁵ - Hold the Control channel at this value for at least one second. If the lamp is currently off, turning the lamp on in this way causes the fixture to home. (If the lamp was already on, the command has no effect.)

⁶ - Hold the Control channel at this value for at least one second. The lamp will also turn on whenever you power up the fixture on a link when there is a controller present and it is sending data commands.

Technoray™ Protocol

Table 2 gives the DMX channel assignments for the Technoray full 14-channel protocol and reduced 12-channel protocol. The column “Ch. (F)” lists channel assignments for the full protocol and the column “Ch. (R)” lists channel assignments for the reduced protocol.

Table 2. Technoray DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
1	1	Color wheel functions Fast color change (at beginning of wheel movement) Select the parameter with this channel. Then use ch. 2 to set the position or spin speed.	Indexed (wheel snaps to center of aperture)	0 - 15	0 - 5	00h - 0Fh
			Forward spin	16 - 31	6 - 12	10h - 1Fh
			Reverse spin	32 - 47	13 - 18	20h - 2Fh
			Continuous	48 - 63	19 - 24	30h - 3Fh
			Slow scan	64 - 79	25 - 30	40h - 4Fh
			Fast scan	80 - 95	31 - 37	50h - 5Fh
			Random	96 - 111	38 - 43	60h - 6Fh
			Blink (same as index, except shutter closes between apertures)	112 - 127	44 - 49	70h - 7Fh
		Color changes set by MSPEED (use ch. 12 (F) or 11 (R) to set MSPEED time) Select the function with this channel. Then use ch. 2 to set the position or spin speed.	Indexed (wheel snaps to center of aperture)	128 - 143	50 - 56	80h - 8Fh
			Forward spin	144 - 159	57 - 62	90h - 9Fh
			Reverse spin	160 - 175	63 - 68	A0h - AFh
			Continuous	176 - 191	69 - 74	B0h - BFh
			Slow scan	192 - 207	75 - 81	C0h - CFh
			Fast scan	208 - 223	82 - 87	D0h - DFh
			Random	224 - 239	88 - 93	E0h - EFh
			Blink (same as index, except shutter closes between apertures)	240 - 255	94 - 100	F0h - FFh
2	2	Color wheel position and functions Position (aperture) selection for blink or index mode (use with ch. 1)	Position 1 (open)	0 - 23 248 - 255	0 - 9 97 - 100	00h - 17h F8h - FFh
			Position 2	24 - 31	9 - 12	18h - 1Fh
			Position 3	32 - 39	13 - 15	20h - 27h
			Position 4	40 - 47	16 - 18	28h - 2Fh
			Position 5	48 - 55	19 - 22	30h - 37h
			Position 6	56 - 63	22 - 24	38h - 3Fh
			Position 7	64 - 71	25 - 27	40h - 47h
			Position 8	72 - 79	28 - 30	48h - 4Fh
			Position 9	80 - 87	31 - 34	50h - 57h
			Position 10	88 - 95	35 - 37	58h - 5Fh
			Position 11	96 - 103	38 - 40	60h - 67h
			Position 12	104 - 111	41 - 43	68h - 6Fh
			Position 13	112 - 127	44 - 49	70h - 7Fh
			Half color 1 and 2	128 - 143	50 - 56	80h - 8Fh
			Half color 2 and 3	144 - 151	57 - 59	90h - 97h
			Half color 3 and 4	152 - 159	60 - 62	98h - 9Fh
Half color 4 and 5	160 - 167	63 - 65	A0h - A7h			
Half color 5 and 6	168 - 175	66 - 68	A8h - AFh			

Table 2. Technoray DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
			Half color 6 and 7	176 - 183	69 - 71	B0h - B7h
			Half color 7 and 8	184 - 191	72 - 74	B8h - BFh
			Half color 8 and 9	192 - 199	75 - 78	C0h - C7h
			Half color 9 and 10	200 - 207	79 - 81	C8h - CFh
			Half color 10 and 11	208 - 215	82 - 84	D0h - D7h
			Half color 11 and 12	216 - 223	85 - 87	D8h - DFh
			Half color 12 and 13	224 - 231	88 - 90	E0h - E7h
		Half color 13 and 1	232 - 247	91 - 96	E8h - F7h	
		Color wheel forward/ reverse spin (use with ch. 1)	No spin	0 - 3	0 - 1	00h - 03h
			Slowest spin to fastest spin	4 - 255	2 - 100	04h - FFh
		Color wheel continuous variation (wheel position is 360 * channel dec. value / 255) (use with ch. 1)	Centered on position 1 (open)	0 255	0 100	00h FFh
			Centered on position 2	19	7	13h
			Centered on position 3	39	15	27h
			Centered on position 4	58	23	3Ah
			Centered on position 5	78	31	4Eh
			Centered on position 6	98	38	62h
			Centered on position 7	117	46	75h
			Centered on position 8	137	54	89h
			Centered on position 9	156	61	9Ch
			Centered on position 10	176	69	B0h
Centered on position 11	196		77	C4h		
Centered on position 12	215		84	D7h		
Centered on position 13	235		92	EBh		
3	3	Litho wheel functions Fast litho changes (at beginning of wheel movement) Select the function with this channel. Then use chs. 4, 5 & 6 (F) or chs.4 & 5 (R) set other options. Random and scan pause time set by chs. 5 & 6 (F) or ch. 5 (R)	Indexed (wheel snaps to center of aperture)	0 - 15	0 - 5	00h - 0Fh
			Forward spin	16 - 31	6 - 12	10h - 1Fh
			Reverse spin	32 - 47	13 - 18	20h - 2Fh
			Scan	48 - 63	19 - 24	30h - 3Fh
			Blink (same as index, except shutter closes between apertures)	64 - 79	25 - 30	40h - 4Fh
			Random	80 - 95	31 - 37	50h - 5Fh
			Reserved	96 - 111	38 - 43	60h - 6Fh
			Wheel spin	112 - 127	44 - 49	70h - 7Fh
		Litho changes set by MSpeed (use ch. 12 (F) or 11 (R) to set MSpeed time) Select the parameter with this channel. Then use chs. 4, 5 & 6 (F) or chs.4 & 5 (R) set other options. Random and scan pause time set by ch. 5	Indexed (wheel snaps to center of aperture)	128 - 143	50 - 56	80h - 8Fh
			Forward spin	144 - 159	57 - 62	90h - 9Fh
			Reverse spin	160 - 175	63 - 68	A0h - AFh
			Scan	176 - 191	69 - 74	B0h - BFh
			Blink (same as index, except shutter closes between apertures)	192 - 207	75 - 81	C0h - CFh
			Random	208 - 223	82 - 87	D0h - DFh
			Reserved	224 - 239	88 - 93	E0h - EFh
			Wheel spin	240 - 255	94 - 100	F0h - FFh

Table 2. Technoray DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)	
4	4	Litho wheel position Position (aperture) selection for blink or index mode (use with ch. 3)	Position 1 (open)	0 - 15 240 - 255	0 - 5 94 - 100	00h - 0Fh F0h - FFh	
			Position 2	16 - 47	6 - 18	10h - 2Fh	
			Position 3	48 - 79	19 - 30	30h - 4Fh	
			Position 4	80 - 111	31 - 43	50h - 6Fh	
			Position 5	112 - 143	44 - 56	70h - 8Fh	
			Position 6	144 - 175	57 - 68	90h - AFh	
			Position 7	176 - 207	69 - 81	B0h - CFh	
			Position 8	208 - 239	82 - 93	D0h - EFh	
5	5	Litho rotation (coarse adjustment) and functions	Angular position for blink and index modes	0 - 255	0 - 100	00h - FFh	
			Random	Random pause time, shortest to longest	0 - 255	0 - 100	00h - FFh
			Scan	Scan rate, slowest to fastest	0 - 255	0 - 100	00h - FFh
			Wheel spin Entire wheel spins, not individual lithos	Forward spin, fastest to slowest	0 - 119	0 - 47	0 - 77h
				No spin	120 - 135	47 - 53	78h - 87h
				Reverse spin, slowest to fastest	136 - 255	53 - 100	88h - FFh
6	n/a	Litho rotation (fine adjustment)	Angular position for blink and index modes	0 - 255	0 - 100	00h - FFh	
7	6	Effects position Fast effects change (at beginning of wheel movement) Select the position with this channel. Then use ch. 8 (F) or ch. 7 (R) to set spin direction and speed. Effects changes set by MSPEED (use ch. 12 (F) or 11 (R) to set MSPEED time) Select the position with this channel. Then use ch. 8 (F) or ch. 7 (R) to set spin direction and speed.	Position 1	0 - 25	0 - 9	00h - 19h	
			Position 2	26 - 51	10 - 20	1Ah - 33h	
			Position 3	52 - 76	21 - 29	34h - 4Ch	
			Position 4	77 - 102	31 - 40	4Dh - 66h	
			Position 5	103 - 127	41 - 49	67h - 7Fh	
			Position 1	128 - 153	50 - 60	80h - 99h	
			Position 2	154 - 178	61 - 69	9Ah - B2h	
			Position 3	179 - 204	70 - 80	B2h - CCh	
			Position 4	205 - 229	81 - 89	CDh - E5h	
			Position 5	230 - 255	90 - 100	E6h - FFh	
8	7	Effects spin speed (use with ch. 7 (F) or 6 (R))	Forward spin fast to slow forward spin	0 - 120	0 - 47	00h - 78h	
			No spin	121 - 134	48 - 52	79h - 86h	
			Reverse spin slow to fast forward spin	135 - 255	53 - 100	87h - FFh	
9	8	Focus	Variable focus	0 - 255	0 - 100	00h - FFh	
10	9	Shutter Longest ramp time = lowest value (snap time is always short)	Closed	0 - 7	0 - 2	00h - 07h	
			Periodic strobe	8 - 67	3 - 26	08h - 43h	
			Random strobe	68 - 127	27 - 49	44h - 7Fh	
			Ramp open, snap shut	128 - 187	50 - 73	80h - BBh	
			Snap open, ramp shut	188 - 247	74 - 96	BCh - F7h	
			Open	248 - 255	97 - 100	F8h - FFh	
11	10	Dim	Full dark to full bright	0 - 255	0 - 100	00h - FFh	

Table 2. Technoray DMX Assignments

Ch. (F)	Ch. (R)	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
12	11	MSpeed	Movement time (see Table 4 on page 15)			
13	n/a	Macros	Macro 1—28 (see Table 5 on page 19)			
14	12	Control¹	Safe ²	0 - 7	0 - 3	00h - 07h
			Display off	24 - 26	9 - 10	18h - 1Ah
			Display dim	32 - 34	13	20h - 22h
			Display bright	40 - 42	16	28h - 2Ah
			Home ³	64 - 66	25 - 26	40h - 42h
			Lamp on ⁴	80 - 82	31 - 32	50h - 52h
			Lamp off ⁵	96 - 98	38	60h - 62h
			Shutdown	128 - 130	50 - 51	80h - 82h

¹ - You must set the Shutter channel to zero before accessing the Control channel.

² - When set to Safe, the control channel has no effect if the shutter is closed.

³ - Hold the Control channel at this value for at least one second. Homing the fixture in this way does not change the state of the lamp (if the lamp was off, it stays off; if the lamp was on, it stays on).

⁴ - Hold the Control channel at this value for at least one second. If the lamp is currently off, turning the lamp on in this way causes the fixture to home. (If the lamp was already on, the command has no effect.)

⁵ - Hold the Control channel at this value for at least one second. The lamp will also turn ON whenever you power up the fixture if a controller is sending data commands on the link.

Technopro™ Protocol

Table 3 gives the DMX channel assignments for the Technopro 12-channel protocol.

Table 3. Technopro DMX Assignments

Ch.	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
1	Color wheel 1 functions Fast color change (at beginning of wheel movement) Select the function with this channel. Then use ch. 2 to set the position or spin speed.	Indexed	0 - 15	0 - 6	00h - 0Fh
		Forward spin	16 - 31	6 - 12	10h - 1Fh
		Reverse spin	32 - 47	13 - 18	20h - 2Fh
		Continuous	48 - 63	19 - 25	30h - 3Fh
		Slow scan	64 - 79	25 - 31	40h - 4Fh
		Fast scan	80 - 95	31 - 37	50h - 5Fh
		Random	96 - 111	38 - 44	60h - 6Fh
		Blink	112 - 127	44 - 50	70h - 7Fh
	Color changes set by MSpeed (use ch. 10 to set MSpeed time) Select the parameter with this channel. Then use ch. 2 to set the position or spin speed.	Indexed	128 - 143	50 - 56	80h - 8Fh
		Forward spin	144 - 159	56 - 62	90h - 9Fh
		Reverse spin	160 - 175	63 - 69	A0h - AFh
		Continuous	176 - 191	69 - 75	B0h - BFh
		Slow scan	192 - 207	75 - 81	C0h - CFh
		Fast scan	208 - 223	82 - 87	D0h - DFh
		Random	224 - 239	88 - 94	E0h - EFh
		Blink	240 - 255	94 - 100	F0h - FFh
2	Color wheel 1 position and functions Position (aperture) selection for blink or index mode (use with ch. 1)	Position 1 (open)	0 - 23 248 - 255	0 - 9 97 - 100	00h - 17h F8h - FFh
		Position 2	24 - 31	9 - 12	18h - 1Fh
		Position 3	32 - 39	13 - 15	20h - 27h
		Position 4	40 - 47	16 - 18	28h - 2Fh
		Position 5	48 - 55	19 - 22	30h - 37h
		Position 6	56 - 63	22 - 25	38h - 3Fh
		Position 7	64 - 71	25 - 28	40h - 47h
		Position 8	72 - 79	28 - 31	48h - 4Fh
		Position 9	80 - 87	31 - 34	50h - 57h
		Position 10	88 - 95	35 - 37	58h - 5Fh
		Position 11	96 - 103	38 - 40	60h - 67h
		Position 12	104 - 111	41 - 44	68h - 6Fh
		Position 13	112 - 127	44 - 50	70h - 7Fh
		Half color 1 and 2	128 - 143	50 - 56	80h - 8Fh
		Half color 2 and 3	144 - 151	56 - 59	90h - 97h
		Half color 3 and 4	152 - 159	60 - 62	98h - 9Fh
		Half color 4 and 5	160 - 167	63 - 65	A0h - A7h
		Half color 5 and 6	168 - 175	66 - 69	A8h - AFh
		Half color 6 and 7	176 - 183	69 - 72	B0h - B7h
		Half color 7 and 8	184 - 191	72 - 75	B8h - BFh
Half color 8 and 9	192 - 199	75 - 78	C0h - C7h		
Half color 9 and 10	200 - 207	78 - 81	C8h - CFh		
Half color 10 and 11	208 - 215	82 - 84	D0h - D7h		

Table 3. Technopro DMX Assignments

Ch.	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
		Half color 11 and 12	216 - 223	85 - 87	D8h - DFh
		Half color 12 and 13	224 - 231	88 - 91	E0h - E7h
		Half color 13 and 1	232 - 247	91 - 97	E8h - F7h
	Color wheel continuous forward/ reverse spin (use with ch.1)	No spin	0 - 3	0 - 1	00h - 03h
		Slowest spin to fastest spin	4 - 255	2 - 100	04h - FFh
	Color wheel continuous variation (wheel position is 360 * channel dec. value / 255) Use with ch.1	Centered on position 1 (open)	0 255	0 100	00h FFh
		Centered on position 2	19	7	13h
		Centered on position 3	39	15	27h
		Centered on position 4	58	23	3Ah
		Centered on position 5	78	31	4Eh
		Centered on position 6	98	38	62h
		Centered on position 7	117	46	75h
		Centered on position 8	137	54	89h
		Centered on position 9	156	61	9Ch
		Centered on position 10	176	69	B0h
		Centered on position 11	196	77	C4h
		Centered on position 12	215	84	D7h
Centered on position 13		235	92	EBh	
3	Color wheel 2 functions	same as ch. 1	see ch. 1	see ch. 1	see ch. 1
4	Color wheel 2 position and functions Aperture selection for blink or index mode (use with ch. 1)	Position 1 (open)	0 - 15 240 - 255	0 - 6 94 - 100	00h - 0Fh F0h - FFh
		Position 2	16 - 47	6 - 18	10h - 2Fh
		Position 3	48 - 79	19 - 31	30h - 4Fh
		Position 4	80 - 111	31 - 44	50h - 6Fh
		Position 5	112 - 143	44 - 56	70h - 8Fh
		Position 6	144 - 175	56 - 69	90h - AFh
		Position 7	176 - 207	69 - 81	B0h - CFh
		Position 8	208 - 239	82 - 94	D0h - EFh
	Color wheel 2 wheel forward/ reverse spin (use with ch. 3)	No spin	0 - 3	0 - 1	00h - 03h
		Fast forward/reverse spin to slow forward/reverse spin	4 - 255	2 - 100	04h - FFh
	Color wheel 2 continuous (use with ch. 3) Wheel position = 360 * (ch. dec. value/255)	Centered on position 1 (open)	0 255	0 100	00h FFh
		Centered on position 2	32	13	20h
		Centered on position 3	64	25	40h
		Centered on position 4	96	38	60h
		Centered on position 5	128	50	80h
Centered on position 6		159	62	9Fh	
Centered on position 7		191	75	BFh	
Centered on position 8	223	87	DFh		

Table 3. Technopro DMX Assignments

Ch.	Construct	Parameter	Value (dec.)	Value (%)	Value (hex)
5	Effects position Fast effects change (at beginning of wheel movement) Select the position with this channel. Then use ch. 6 to set spin direction and speed.	Position 1	0 - 25	0 - 10	00h - 19h
		Position 2	26 - 51	10 - 20	1Ah - 33h
		Position 3	52 - 76	20 - 30	34h - 4Ch
		Position 4	77 - 102	30 - 40	4Dh - 66h
		Position 5	103 - 127	40 - 50	67h - 7Fh
	Effects changes set by MSpeed (use ch. 10 to set MSpeed time) Select the position with this channel. Then use ch. 6 to set spin direction and speed	Position 1	128 - 153	50 - 60	80h - 99h
		Position 2	154 - 178	60 - 70	9Ah - B2h
		Position 3	179 - 204	70 - 80	B3h - CCh
		Position 4	205 - 229	81 - 89	CDh - E5h
		Position 5	230 - 255	90 - 100	E6h - FFh
6	Effects spin speed (use with ch. 5)	Forward spin fast to slow forward spin	0 - 120	0 - 47	00h - 78h
		No spin	121 - 134	47 - 53	79h - 86h
		Reverse spin slow to fast reverse spin	135 - 255	53 - 100	87h - FFh
7	Focus	Variable focus	0 - 255	0 - 100	00h - FFh
8	Shutter Longest ramp time = lowest value (snap time is always short)	Closed	0 - 7	0 - 3	00h - 07h
		Periodic strobe	8 - 67	3 - 26	08h - 43h
		Random strobe	68 - 127	27 - 50	44h - 7Fh
		Ramp open, snap shut	128 - 187	50 - 73	80h - BBh
		Snap open, ramp shut	188 - 247	74 - 97	BCh - F7h
		Open	248 - 255	97 - 100	F8h - FFh
9	Dim	Full dark to full bright	0 - 255	0 - 100	00h - FFh
10	MSpeed	Movement time (see Table 4 on page 15)			
11	Macros	Macro 1—28 (see Table 5 on page 19)			
12	Control¹	Safe ²	0 - 7	0 - 3	00h - 07h
		Display off	24 - 26	9 - 10	18h - 1Ah
		Display dim	32 - 34	13	20h - 22h
		Display bright	40 - 42	16	28h - 2Ah
		Home ³	64 - 66	25 - 26	40h - 42h
		Lamp on ⁴	80 - 82	31 - 32	50h - 52h
		Lamp off ⁵	96 - 98	38	60h - 62h
		Shutdown	128 - 130	50 - 51	80h - 82h

¹ - You must set the Shutter channel to zero before accessing the Control channel.

² - When set to Safe, the control channel has no effect if the shutter is closed.

³ - Hold the Control channel at this value for at least one second. Homing the fixture in this way does not change the state of the lamp (if the lamp was off, it stays off; if the lamp was on, it stays on).

⁴ - Hold the Control channel at this value for at least one second. If the lamp is currently off, turning the lamp on in this way causes the fixture to home. (If the lamp was already on, the command has no effect.)

⁵ - Hold the Control channel at this value for at least one second. The lamp will also turn ON whenever you power up the fixture if a controller is sending data commands on the link.

MSpeed Movement Times

Use Table 4 to determine the MSpeed (motor/mirror) movement times for Technobeam, Technopro or Technoray in seconds.

An MSpeed (motor/mirror speed) change occurs smoothly over the entire MSpeed time value. For example, if you choose a numerical DMX value of 202 for an MSpeed color change from position 2 to position 4, that means the color wheel changes gradually to position 4 over 11.41 seconds.

Note The values displayed in the “Value (%)” , “Value (hex)” and “Value (num)” columns may vary slightly depending on your controller’s rounding conventions.

Table 4. MSpeed Movement Times

Time (sec.)	Value (dec.)	Value (%)	Value (hex)	Time (sec.)	Value (dec.)	Value (%)	Value (hex)
0.15	255	100	FFh	2.27	232	91	E8h
0.15	254	100	FEh	2.46	231	91	E7h
0.17	253	99	FDh	2.66	230	90	E6h
0.19	252	99	FCh	2.86	229	90	E5h
0.21	251	98	FBh	3.07	228	89	E4h
0.25	250	98	FAh	3.29	227	89	E3h
0.29	249	98	F9h	3.52	226	89	E2h
0.35	248	97	F8h	3.76	225	88	E1h
0.41	247	97	F7h	4.00	224	88	E0h
0.47	246	96	F6h	4.25	223	87	DFh
0.55	245	96	F5h	4.52	222	87	DEh
0.63	244	96	F4h	4.78	221	87	DDh
0.73	243	95	F3h	5.06	220	86	DCh
0.83	242	95	F2h	5.34	219	86	DBh
0.94	241	95	F1h	5.64	218	85	DAh
1.05	240	94	F0h	5.94	217	85	D9h
1.18	239	94	EFh	6.25	216	85	D8h
1.31	238	93	EEh	6.56	215	84	D7h
1.45	237	93	EDh	6.89	214	84	D6h
1.60	236	93	ECh	7.22	213	84	D5h
1.75	235	92	EBh	7.56	212	83	D4h
1.92	234	92	EAh	7.91	211	83	D3h
2.09	233	91	E9h	8.27	210	82	D2h

Table 4. MSpeed Movement Times

Time (sec.)	Value (dec.)	Value (%)	Value (hex)	Time (sec.)	Value (dec.)	Value (%)	Value (hex)
8.63	209	82	D1h	26.45	174	68	A Eh
9.00	208	82	D0h	27.10	173	68	ADh
9.39	207	81	CFh	27.76	172	67	AC h
9.77	206	81	CEh	28.43	171	67	ABh
10.17	205	80	CDh	29.11	170	67	AAh
10.58	204	80	CCh	29.80	169	66	A9h
10.99	203	80	CBh	30.49	168	66	A8h
11.41	202	79	CAh	31.19	167	65	A7h
11.84	201	79	C9h	31.90	166	65	A6h
12.28	200	78	C8h	32.62	165	65	A5h
12.72	199	78	C7h	33.34	164	64	A4h
13.17	198	78	C6h	34.08	163	64	A3h
13.63	197	77	C5h	34.82	162	64	A2h
14.10	196	77	C4h	35.57	161	63	A1h
14.58	195	76	C3h	36.33	160	63	A0h
15.07	194	76	C2h	37.09	159	62	9Fh
15.56	193	76	C1h	37.87	158	62	9Eh
16.06	192	75	C0h	38.65	157	62	9Dh
16.57	191	75	BFh	39.44	156	61	9Ch
17.09	190	75	BEh	40.23	155	61	9Bh
17.61	189	74	BDh	41.04	154	60	9Ah
18.14	188	74	BCh	41.85	153	60	99h
18.68	187	73	BBh	42.68	152	60	98h
19.23	186	73	BAh	43.50	151	59	97h
19.79	185	73	B9h	44.34	150	59	96h
20.36	184	72	B8h	45.19	149	58	95h
20.93	183	72	B7h	46.04	148	58	94h
21.51	182	71	B6h	46.90	147	58	93h
22.10	181	71	B5h	47.77	146	57	92h
22.70	180	71	B4h	48.65	145	57	91h
23.30	179	70	B3h	49.54	144	56	90h
23.92	178	70	B2h	50.43	143	56	8Fh
24.54	177	69	B1h	51.33	142	56	8Eh
25.17	176	69	B0h	52.24	141	55	8Dh
25.80	175	69	AFh	53.16	140	55	8Ch

Table 4. MSpeed Movement Times

Time (sec.)	Value (dec.)	Value (%)	Value (hex)	Time (sec.)	Value (dec.)	Value (%)	Value (hex)
54.09	139	55	8Bh	91.55	104	41	68h
55.02	138	54	8Ah	92.76	103	40	67h
55.96	137	54	89h	93.98	102	40	66h
56.91	136	53	88h	95.21	101	40	65h
57.87	135	53	87h	96.45	100	39	64h
58.84	134	53	86h	97.70	99	39	63h
59.81	133	52	85h	98.95	98	38	62h
60.79	132	52	84h	100.22	97	38	61h
61.78	131	51	83h	101.49	96	38	60h
62.78	130	51	82h	102.77	95	37	5Fh
63.79	129	51	81h	104.05	94	37	5Eh
64.80	128	50	80h	105.35	93	36	5Dh
65.82	127	50	7Fh	106.65	92	36	5Ch
66.85	126	49	7Eh	107.96	91	36	5Bh
67.89	125	49	7Dh	109.28	90	35	5Ah
68.94	124	49	7Ch	110.61	89	35	59h
69.99	123	48	7Bh	111.94	88	35	58h
71.05	122	48	7Ah	113.28	87	34	57h
72.13	121	47	79h	114.63	86	34	56h
73.20	120	47	78h	115.99	85	33	55h
74.29	119	47	77h	117.36	84	33	54h
75.38	118	46	76h	118.73	83	33	53h
76.49	117	46	75h	120.12	82	32	52h
77.60	116	45	74h	121.51	81	32	51h
78.71	115	45	73h	122.91	80	31	50h
79.84	114	45	72h	124.31	79	31	4Fh
80.98	113	44	71h	125.73	78	31	4Eh
82.12	112	44	70h	127.15	77	30	4Dh
83.27	111	44	6Fh	128.58	76	30	4Ch
84.43	110	43	6Eh	130.02	75	29	4Bh
85.59	109	43	6Dh	131.47	74	29	4Ah
86.77	108	42	6Ch	132.92	73	29	49h
87.95	107	42	6Bh	134.39	72	28	48h
89.14	106	42	6Ah	135.86	71	28	47h
90.34	105	41	69h	137.34	70	27	46h

Table 4. MSpeed Movement Times

Time (sec.)	Value (dec.)	Value (%)	Value (hex)	Time (sec.)	Value (dec.)	Value (%)	Value (hex)
138.82	69	27	45h	195.92	34	13	22h
140.32	68	27	44h	197.70	33	13	21h
141.82	67	26	43h	199.48	32	13	20h
143.33	66	26	42h	201.28	31	12	1Fh
144.85	65	25	41h	203.08	30	12	1Eh
146.38	64	25	40h	204.88	29	11	1Dh
147.92	63	25	3Fh	206.70	28	11	1Ch
149.46	62	24	3Eh	208.52	27	11	1Bh
151.01	61	24	3Dh	210.36	26	10	1Ah
152.57	60	24	3Ch	212.19	25	10	19h
154.14	59	23	3Bh	214.04	24	9	18h
155.71	58	23	3Ah	215.90	23	9	17h
157.30	57	22	39h	217.76	22	9	16h
158.89	56	22	38h	219.63	21	8	15h
160.49	55	22	37h	221.51	20	8	14h
162.09	54	21	36h	223.40	19	7	13h
163.71	53	21	35h	225.30	18	7	12h
165.33	52	20	34h	227.20	17	7	11h
166.96	51	20	33h	229.11	16	6	10h
168.60	50	20	32h	231.03	15	6	0Fh
170.25	49	19	31h	232.96	14	5	0Eh
171.91	48	19	30h	234.90	13	5	0Dh
173.57	47	18	2Fh	236.84	12	5	0Ch
175.24	46	18	2Eh	238.79	11	4	0Bh
176.92	45	18	2Dh	240.75	10	4	0Ah
178.61	44	17	2Ch	242.72	9	4	09h
180.30	43	17	2Bh	244.70	8	3	08h
182.01	42	16	2Ah	246.68	7	3	07h
183.72	41	16	29h	248.68	6	2	06h
185.44	40	16	28h	250.68	5	2	05h
187.17	39	15	27h	252.68	4	2	04h
188.90	38	15	26h	0.19	3	1	03h
190.65	37	15	25h	0.19	2	1	02h
192.40	36	14	24h	0.19	1	0	01h
194.16	35	14	23h	0.19	0	0	00h

Macro Channel Assignments

Table 5 below lists the macro channel assignments as of the time this manual went to print (November 1997). *This information is preliminary and subject to change.* A macro is predefined set of constructs you can use when programming a scene. You do not have to use macros in your scene, but using them can save you time.

The DMX channel numbers you use to access macros are listed below:

- **Technobeam full protocol:** 17
- **Technoray full protocol:** 13
- **Technopro protocol:** 11

Table 5. Macro DMX Channel Assignments

Macro no.	Value (dec.)	Value (%)	Value (hex)				
off	0 - 7 120 - 255	0 - 3 47 - 100	00h - 07h 78h - FFh	21	88 - 91	35	58h - 5Bh
1	8 - 11	4	08h - 0Bh	22	92 - 95	36 - 37	5Ch - 5Fh
2	12 - 15	5	0Ch - 0Fh	23	96 - 99	38	60h - 63h
3	16 - 19	6 - 7	10h - 13h	24	100 - 103	39 - 40	64h - 67h
4	20 - 23	8 - 9	14h - 17h	25	104 - 107	41	68h - 6Bh
5	24 - 27	10	18h - 1Bh	26	108 - 111	42 - 43	6Ch - 6Fh
6	28 - 31	11 - 12	1Ch - 1Fh	27	112 - 115	44 - 45	70h - 73h
7	32 - 35	13	20h - 23h	28	116 - 119	46	74h - 77h
8	36 - 39	14 - 15	24h - 27h				
9	40 - 43	16	28h - 2Bh				
10	44 - 47	17 - 18	2Ch - 2Fh				
11	48 - 51	19 - 20	30h - 33h				
12	52 - 55	21	34h - 37h				
13	56 - 59	22 - 23	38h - 3Bh				
14	60 - 63	24	3Ch - 3Fh				
15	64 - 67	25 - 26	40h - 43h				
16	68 - 71	27	44h - 47h				
17	72 - 75	28 - 29	48h - 4Bh				
18	76 - 79	30	4Ch - 4Fh				
19	80 - 83	31 - 32	50h - 53h				
20	84 - 87	33 - 34	54h - 57h				

Fixture Number to DMX Start Channel

Table 6 below shows the conversion between fixture number and DMX start channel. You must understand and use this information if you choose to control Technobeam, Technopro and Technoray fixtures using fixture numbering.

Table 6. Fixture Number to DMX Start Channel Conversion

Fixt. no. 1—28	18-ch. (TB F)	14-ch. (TB R, TR F)	12-ch. (TR R, TPRO)	Fixt. no. 29—43	14-ch.	12-ch.
	DMX start channel				DMX start channel	
1	1	1	1	29	393	337
2	19	15	13	30	407	349
3	37	29	25	31	421	361
4	55	43	37	32	435	373
5	73	57	49	33*	449	385
6	91	71	61	34*	463	397
7	109	85	73	35*	477	409
8	127	99	85	36*	491	421
9	145	113	97	37*		433
10	163	127	109	38*		445
11	181	141	121	39*		457
12	199	155	133	40*		469
13	217	169	145	41*		481
14	235	183	157	42*		493
15	253	197	169	* - A link with more than 32 fixtures requires a serial data distributor to regenerate and retime the signal. Maximum number of fixtures per link: 18-channel protocol: 28 14-channel protocol: 36 12-channel protocol: 42		
16	271	211	181			
17	289	225	193			
18	307	239	205			
19	325	253	217			
20	343	267	229			
21	361	281	241			
22	379	295	253			
23	397	309	265			
24	415	323	277			
25	433	337	289			
26	451	351	301			
27	469	365	313			
28	487	379	325			