

Strand Lighting Specification

I. DIGITAL ENVIRON 90 DIMMER CABINET(S)

A. GENERAL

1. The dimmer cabinets shall be fully digital, designed specifically for architectural and entertainment lighting applications, and shall consist of 6 or 12 dimmer module spaces, depending on cabinet size. Dimmer systems shall be UL and CSA listed.
2. Cabinet setup and preset data shall, as standard, be fully user programmable on a per cabinet or system wide basis.

B. MECHANICAL

1. The dimmer cabinet shall be a free standing, dead-front switchboard, substantially framed and enclosed with 16-gauge, formed steel panels. All cabinet components shall be properly treated, primed and finished in fine texture, scratch resistant, grey powder coat paint.
2. The dimensions of the cabinets shall be as follows:
 - a. Small: 6" (152mm) deep, 36" (914mm) high and 30" (762mm) wide. (Height dimension excludes 2" (51mm) mounting flange top and bottom).
 - b. Large: 6" (152mm) deep, 72" (1829mm) high and 30" (762mm) wide. (Height dimension excludes 2" (51mm) mounting flange on top of cabinet).
3. Cabinets shall be wall mounted with 0.375" (9.5mm) mounting holes on 16" (410mm) and 24" (610mm) centers. The large cabinet shall be provided with support legs for floor mounting.
4. The small and large dimmer cabinets shall be cooled by one or two 4.69" (119mm) low noise fans respectively. The fans shall maintain the temperature of all components within the ambient temperature range defined in the Environmental Specification with all power modules under full load.
5. Over-temperature sensing shall be provided, and will shut down the power modules until the temperature falls to within acceptable limits. An over-temperature indicator shall be provided on the front of the Processor Module.

C. INSTALLATION

1. The cabinet shall be factory pre-wired and dressed. The contractor shall provide and terminate all feed, load and control wiring on screw terminals fitted within the cabinet.
2. Cable entry points shall be as follows:
 - a. Small Cabinet:
 - i. Power feed: 5" (127mm) x 5" (127mm) on the top panel.
 - ii. Load Cables: 23" (584mm) x 5" (127mm) and 5" (127mm) x 5" (127mm) on the top and right hand side panel respectively.
 - iii. Control: 5" (127mm) x 5" (127mm) on the left hand side panel.
 - b. Large Cabinet:
 - i. Power feed: 8" (203mm) x 5" (127mm) on the top panel.
 - ii. Load Cables: 10" (254mm) x 5" (127mm) and 12" (305mm) x 5" (127mm) on the top and right hand side panel respectively.
 - iii. Control: 5" (127mm) x 5" (127mm) on the left hand side panel.
3. All terminations and internal wiring shall be accessible via a hinged lockable door and removable front cover panel. The Processor Module shall be accessible for programming only when the door is open.

D. ELECTRICAL

1. The power efficiency of the dimmer cabinet shall be greater than 95% at full load.
2. The small and large cabinet shall be suitable for 90 - 240 Volt 1 phase 3 wire or 3 phase 4 wire 60/50 Hz supply and shall contain any combination of up to 6 or 12 Power Modules of the appropriate supply voltage. The total number of dimmer circuits per cabinet shall not exceed 24.
 - a. Note: Quad Power Modules shall only be used with the small dimmer cabinet, and shall require a Quad Module Kit.
3. Power feed terminals shall accept the following cable sizes:

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- a. Small Cabinet: #2/0 to #12 AWG
 - b. Large Cabinet: 400 MCM to #6 AWG
4. The dimmer cabinet shall have an internal dual output power supply to support up to (20) 10vdc or 24vdc architectural control stations. A supplementary Power Supply shall also be available.
 5. A "Panic" facility shall turn selected dimmers full on if the Processor Module is removed or fails. Dimmers are selected from dip switches within the cabinet. It shall also be possible to select "Panic" as follows:
 - a. A momentary switch with LED indicator on the front of the cabinet selects "Panic". A second momentary switch returns the cabinet to "Normal".
 - b. Remote latching contact closure.
 - c. Two remote momentary contact closures for "Panic" and "Normal" respectively.
 6. A six pin female XLR chassis mounted connector shall be mounted on the face of the dimmer cabinet for connection of an System Wide Control hand held programmer.
 7. The system ground shall be made at a grounding lug in the top of the dimmer cabinet.
 8. All equipment shall be UL listed and CSA approved.

E. CABINET ELECTRONICS, PHYSICAL

1. Each Digital Environ cabinet shall have a number of user programmable parameters and defaults which may be reported and programmed from the Processor Module membrane keypad and 16 character LCD display. All programmable parameters have factory default values.
2. The display shall provide programming messages, prompts and fault reporting.
3. The keypad shall be protected with multiple level security codes to prevent unauthorised access to selected set-up menus.
4. The Processor Module single chip microcontroller shall be protected by watchdog circuitry, providing stability, speed and precise digital control of the Power Modules.
5. Fade resolution shall typically be greater than 1600 steps ensuring smooth fades. Systems with lower resolution shall not be acceptable.
6. All data storage in the dimmer processor shall have security systems to prevent unintentional re-programming or loss of data.
7. User programmed information shall be held in non-volatile memory which retains its data in the event of power switch off or failure. Systems requiring batteries shall not be acceptable.
8. The Processor Module shall be protected by a 2A SS HRC fuse link.

F. CABINET ELECTRONICS, CONTROL AND COMMUNICATION

1. The following control protocols shall be supported by Digital Environ without need for modification to the Cabinet or Processor Module. All control terminations are via screw terminal connectors.
 - a. Digital Network Control - operating on a highest level takes precedence basis with:
 - b. Multiplex Input - DMX 512 or D54 - operating on a highest level takes precedence basis with:
 - c. Optional 2nd Multiplex Input - DMX 512 - operating on a highest level takes precedence basis with:
 - d. 26 Analog inputs - 24 for internal dimmers, 2 for external 0-10Vdc-controlled equipment - operating on a highest takes precedence basis with:
 - e. Processor keypad (when recalling Digital Network presets) - operating on a highest takes precedence basis with:
 - f. Processor keypad - when recalling System Wide Control presets - operating on a last action takes precedence basis with:
 - g. System Wide Control stations, System Wide Control hand held programmer recalling presets - all operating on an override basis with:
 - h. Processor Keypad - Using the "Level" menu option or System Wide Control when controlling individual channels.
2. The Processor Module shall support 24 digital outputs to drive single, dual and quad Power Modules. In addition, two 0 to +10 volt analog outputs (at 1mA maximum) shall be provided for auxiliary control capability (e.g. electronic fluorescent ballast controllers). These analog outputs may be patched to the DMX-512, Digital Network, or System Wide Control inputs.

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G. CABINET ELECTRONICS, FEATURES

1. The following options shall be available from the Set-up menu, using a keypad access code:
 - a. Language: English, French, German
 - b. Dimmer module assignments: The arrangement of Single, Dual or Quad Power Modules for each module position is programmed.
 - i. From this information, physical dimmers and both analog outputs are given sequential dimmer numbers to simplify programming of other features.
 - c. Rack number: 1 - 99. Used for SWC
 - d. Max output voltage (per dimmer): 50-250 volts e.g. Set to 105V for extended lamp life.
 - e. Min level (per dimmer): 0% - 25% e.g. Set to 10% for safety purposes.
 - f. Reset to factory defaults
2. The following options shall be accessed directly from the membrane keypad buttons:
 - a. Patch
 - i. Digital Network (Architectural) Control: Each dimmer and analog output shall be patched to a room (between 1 and 16) and channel number (between 1 and 15).
 - ii. Multiplex Control: Each dimmer and analog output shall be patched to any valid DMX or D54 address number for both the standard multiplex input A and optional multiplex input B.
 - iii. Analog Control : Each dimmer and analog output shall automatically be assigned in sequence to its numerically corresponding analog input.
 - b. Mux Input: Select DMX or D54 for mux input A.
 - c. Non-Dim: Individual assignment of dimmers as non-dims with threshold levels programmable between 1%-99%.
 - d. Curve: Response curve assignment per dimmer: Linear Power, Square, S-Curve or Fluorescent (with top and bottom set levels).
 - e. Response Speed: Dimmer response: fast (30ms), normal (100ms) or slow (300ms). This shall determine a dimmers rate of response to a change in control level. Slow is usually set for large tungsten loads to reduce filament inrush; medium or fast for small loads.
 - f. Architectural Presets:
 - i. Recall preset 1-8, On and Off for each room.
 - ii. Record presets 1-8 and all programmable fade times for each room.
 - iii. Set channel levels for each room.
 - g. Entertainment Presets:
 - i. Recall back-up preset 0 - 99.
 - ii. Record presets 1-99 with fade times.
 - iii. Define Preset No. or "Hold" condition on Mux failure.
 - h. Level: Dimmer control assignment to "Input" (Digital Network, Mux A, Mux B or Analog), or to a fixed level 0% - 99% or "Full".
3. Cursor and Selection Keys
 - a. + / Confirm
 - b. - / Cancel
 - c. < (move cursor to left)
 - d. > (move cursor to right)
4. Service Menus
 - a. The service menus shall give access to cabinet self tests and provide calibration facilities. The service menu shall be entered via a security code to prevent unauthorized access. Service functions available shall include:
 - b. Calibration
 - i. Phase A (L1), B (L2), C (L3) voltages
 - ii. Analog inputs - top set calibrated between 7 and 13 volts.
 - iii. Analog outputs - top set calibrated between 5 and 10 volts.
 - iv. Display; set LCD contrast
 - c. Log
 - i. View Error Log: Errors shall be displayed from the error log as an error number with a text description of the error.
 - ii. Clear Error log: Clears the log.
 - d. Processor Module Indicators

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- i. Phase Indicators: A (L1), B (L2), C (L3).
 - ii. Note: A (L1) and B (L2) illuminate for 1P/3W supplies.
 - iii. Mux A OK
 - iv. Processor OK
 - v. Mux B OK
 - vi. Mux B fitted and OK
 - vii. Over-temperature (indicated by "processor OK" led flashing)
 - viii. Liquid Crystal Display - reporting rack status continuously
5. The Processor shall be immune to mains carried interference (ripple disturbances) of up to 20 Vpp sinusoidal signals at frequencies above 180Hz.

II. POWER MODULES

A. MECHANICAL

1. Power Modules shall be factory wired units of similar size and heavy duty metal construction, designed to be installed into the cabinet as a self contained bolt-in assembly. A plastic Power Module chassis shall not be acceptable
2. The maximum weight of a Power Module shall be 8 lb. (3.6Kg)
3. Modules shall be finished in powder coat grey paint.

B. ELECTRICAL

1. Power connections shall be made on compression screw terminals. Control signal connections shall be made via plug-in connectors at each module chassis.
2. Load connections shall be via compression screw terminals on a terminal block (TB) or branch breaker (BB) assembly. Terminal Block and Branch Breaker Kits shall be available to convert the output format of selected Power Modules.
3. Power Modules shall be suitable for 110/120V or 220/240V, 60 or 50 Hz.
4. Each dimmer shall maintain its output RMS voltage within 2% for changes in load from 100 watts to full rated load at any point on the dimming curve.
5. The power efficiency of each power module shall be better than 95% at full load. Adequate heat sinking shall be provided.
6. Module electronics shall be completely solid state using two silicon controlled rectifiers (SCR's) per dimmer in inverse parallel configuration.
7. SCR devices shall be encapsulated in an epoxy filled high impact plastic case with opto isolator, trigger SCR, steering bridge and snubber network. There shall be a minimum of 2500 volts isolation between the ac line and control lines of the SCR sub-assembly.
8. Each dimmer shall be protected by fully magnetic circuit breaker of the appropriate capacity mounted on the faceplate of the Power Module. This protective device shall have a "must trip" rating of 125% of rated capacity and be rated for a minimum 10,000 Amp interrupting capacity.
9. It shall be possible to use the breaker as a dimmer disconnect device and shall be a UL listed and CSA approved device.
10. Under overload conditions, the breaker will disconnect power to the dimmer to protect the SCR device. Current limiting feedback techniques shall not be acceptable as a means of protecting the main power device.
11. The full load current shall be carried and controlled by the SCR device. Dimmers employing Triacs shall not be acceptable.
12. All Power Modules shall be capable of continuous operation at full rated load. Under no circumstances will Modules allowing continued operation with loads substantially in excess of the rated capacity be acceptable.
13. A Linear Power, Square, S-Curve, Non-Dim or Fluorescent response curve shall be assigned from the Processor Module for each dimmer.
14. Each assigned Non-Dim shall have a programmable switching threshold between 1 and 99%.
15. In addition to a default fluorescent curve, a magnetic or electronic ballast option and programmable top and bottom set levels shall be available to further optimize the curve for each fluorescent dimmer.

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16. Under normal circumstances, fluorescent Power Modules shall use the default response curve with adjustments via trim pot(s) on the module.
17. At full load under normal operating conditions, voltage insertion loss in the dimmer shall be typically 2 volts, but shall not exceed 4 volts.
18. The maximum output voltage level for each individual dimmer shall be programmable from the keypad to any desired point with automatic re-calculation of the assigned dimmer curve across the permitted voltage range.
19. The dimmer outputs shall be regulated to within 1V for every 20V change in the input voltage at 50% control input, provided that the output voltage is more than 4 volts below the dimmer rack input voltage and that the input voltage is sinusoidal.
20. Power Modules shall be UL recognized and CSA approved.

C. FEATURES

1. Specific Features of the Incandescent/Inductive Dimmers shall be as follows:
 - a. Dimmer shall have an integral inductive toroidal filter designed to reduce the rate of rise of current such that the rise time shall not exceed 350 μ s at full load, measured between 10 - 90% of the load current waveform at a 90° conduction angle. Chokes with a higher rise time shall be available to order.
 - i. The filter shall limit objectionable harmonics, reduce acoustical noise in incandescent lamps and limit conducted radio frequency interference on the ac line and load wires.
 - b. The dimmer firing circuitry shall produce an output sine wave that is fully symmetrical to minimize the dc component in the output waveform to within +/- 1 volt dc.
 - c. It shall be possible to dim low and high voltage transformer fed loads providing that the transformer used is approved by the manufacturer for use with phase control dimmers.
 - d. When dimming cold cathode loads with an Incandescent/Inductive Power Module, a fluorescent dimming curve shall be assigned from the Processor keypad to give a bottom set cut-off ensuring the maximum range of stable performance.
2. Specific features of the Fluorescent Dimmer Modules shall be as follows:
 - a. The fluorescent dimmers shall be suitable for dimming conventional 3 wire magnetic ballasts as recommended by the dimming manufacturer.
 - b. A mechanical relay shall be provided for switching on the cathode heater supply when the control level is raised above zero.
 - c. The fluorescent dimmers shall have a "Bottom Set" to adjust the cut-off point ensuring the maximum range of stable performance for both fluorescent and cold cathode loads.
3. Specific features of the Constant-On Modules shall be as follows:
 - a. Constant-On Modules shall allow any circuit to be supplied with constant power through substitution of a Constant-On Module for the Dimmer or Non-Dim Module.
4. Specific features of the Non-Dim Modules shall be as follows:
 - a. Non-dims shall allow any circuit to be switched as a non-dim through substitution of a Non-Dim Module for the Dimmer or Constant-On Module.
 - b. Non-dims shall be designed so that they can be used for inductive (transformer-fed) loads. Non-Dims with chokes shall not be acceptable.

D. ACCESSORIES

1. Terminal Block Kits shall be available for selected Power Modules, to convert branch breaker bussing to terminal block output.
2. Branch Breaker Kits shall provide all necessary parts to convert the indicated terminal block output Power Modules for branch circuit breaker protection. Circuit breaker cover plugs shall be provided with each kit.
3. To supplement the internal Power Supply, an supplemental Power Supply shall be available to support up to 20 additional architectural control stations, and shall be supplied complete with an enclosure for wall mounting in the dimmer/distribution room. It shall be suitable for 90 - 240 volts ac 60 or 50 Hz supplies.

E. DOCUMENTATION

1. System riser and connection drawings shall be supplied as specified.

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2. Installation Instructions and a Pocket Programming Guide, shall be supplied with each Digital Environ Cabinet.

F. STANDARDS

1. The dimmer cabinet assembly shall be UL listed and CSA approved and shall be labeled as such.

G. ENVIRONMENTAL SPECIFICATION

1. Ambient temperature extremes: 32 - 95° F (0 - 35° C)
2. Recommended ambient temperature: 64 - 77° F (18 - 25° C)
3. Relative humidity: 10 - 90% non-condensing
4. General conditions: Office level cleanliness. Interior use only.

H. PROVIDE THE FOLLOWING EQUIPMENT:

Qty.	Cat. No.	Description
#	74016	Digital Environ 90 Cabinet (Small) with Processor
#	74012	Digital Environ 90 Cabinet (Large) with Processor
#	79100	Spare DE90 Processor Module
#	76309	Optional Second DMX-512 Input Card
#	72001	DE90 Power Module, 1 x 2.4kW, Incandescent/Inductive, 110/120V, TB
#	72002	DE90 Power Module, 2 x 2.4kW, Incandescent/Inductive, 110/120V, TB
#	72003	DE90 Power Module, 2 x 2.4kW, Incandescent/Inductive, 110/120V, BB
#	72004	DE90 Power Module, 4 x 1.8kW, Incandescent/Inductive, 110/120V, TB
#	72005	DE90 Power Module, 1 x 6.0kW, Incandescent/Inductive, 110/120V, BB
#	72021	DE90 Power Module, 1 x 2.2kW, Incandescent/Inductive, 220/240V, TB
#	72022	DE90 Power Module, 2 x 2.2kW, Incandescent/Inductive, 220/240V, TB
#	72023	DE90 Power Module, 2 x 2.2kW, Incandescent/Inductive, 220/240V, BB
#	72025	DE90 Power Module, 1 x 5.5kW, Incandescent/Inductive, 220/240V, BB
#	72009	DE90 Power Module, 1 x 20A, Non-Dim, 110/220V, TB
#	72010	DE90 Power Module, 2 x 20A, Non-Dim, 110/220V, TB
#	72011	DE90 Power Module, 2 x 20A, Non-Dim, 110/220V, TB
#	72012	DE90 Power Module, 1 x 50A, Non-Dim, 110/220V, TB
#	72029	DE90 Power Module, 1 x 2.2kW, Non-Dim, 220/240V, TB
#	72030	DE90 Power Module, 2 x 2.2kW, Non-Dim, 220/240V, TB
#	72031	DE90 Power Module, 2 x 2.2kW, Non-Dim, 220/240V, BB
#	72032	DE90 Power Module, 1 x 5.5kW, Non-Dim, 220/240V, BB
#	72006	DE90 Power Module, 1 x 2.4kW, Magnetic Fluorescent, 110/120V, TB
#	72007	DE90 Power Module, 2 x 2.4kW, Magnetic Fluorescent, 110/120V, TB
#	72008	DE90 Power Module, 1 x 6.0kW, Magnetic Fluorescent, 110/120V, BB
#	72026	DE90 Power Module, 1 x 2.2kW, Magnetic Fluorescent, 220/240V, TB
#	72027	DE90 Power Module, 2 x 2.2kW, Magnetic Fluorescent, 220/240V, TB
#	72028	DE90 Power Module, 1 x 5.5kW, Magnetic Fluorescent, 220/240V, BB
#	72013	DE90 Power Module, 1 x 50A, Constant-On, 110/120V, BB
#	76800	DE90 Terminal Block Kit
#	76801	Branch Breaker Kit for 6 x 1 Pole Breakers
#	76802	Branch Breaker Kit for 3 x 2 Pole Breakers
#	76803	15A 1 Pole Breaker (GE THQP115)
#	76804	15A 2 Pole Breaker (GE THQP215)
#	76805	20A 1 Pole Breaker (GE THQP120)
#	76806	20A 2 Pole Breaker (GE THQP220)
#	66100	Microcontrol/Outlook Supplementary Power Supply with Enclosure
#	76807	Quad Module Kit (Cable Assembly)