Lighting Equipment that's out there

TS DIMMER

OPERATOR MANUAL

(including Analog option)

Version 1.1

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TABLE OF CONTENTS

1.0 DESCRIPTION 1

2.0 TECHNICAL SPECIFICATIONS 2

3.0 WIRING 4

3.1 INPUT SUPPLY 4
3.2 CONTROL WIRING - ANALOG INPUT (OPTIONAL) 5
3.3 CONTROL WIRING - DIGITAL DIMMERS 5
3.4 REMOTE TEMPERATURE MONITORING 5
3.5 LOAD CONNECTION 5

4.0 OVER LOAD PROTECTION 6

5.0 MOUNTING 6

6.0 TRIMMING - (ANALOG OPTION ONLY) 6

7.0 THE CHANNEL SELECT FUNCTION 7

7.1 THE CHANNEL LATCH FUNCTION 7

8.0 THE CHASE FUNCTION 7

9.00 SELECTING FADE CURVES 8

10.0 THE ADDRESS SETTINGS 10

11.0 PROTOCOLS AND BAUD RATES 11

12.0 SCENE MEMORY STORAGE OPTION 11

13.0 SWITCHING OUTPUT 11

14.0 APPENDIX 1: CONTROL CABLE AND PLUG CONNECTIONS - ANALOG OPTION 12

15.0 APPENDIX 2: CONTROL CABLE AND PLUG CONNECTIONS – DMX512. 13

16.0 APPENDIX 3: PIN DETAILS FOR TEMPERATURE CONNECTOR 14

17.0 APPENDIX 4: PIN DETAILS FOR SOCAPEX 19 PIN CONNECTORS 14

18.0 APPENDIX 5: PIN DETAILS FOR WIELAND & HARTING 16 PIN CONNECTORS 15

19.0 APPENDIX 6: PIN DETAILS FOR WIELAND & HARTING 10 PIN CONNECTORS 15

20.0 APPENDIX 7: PIN CONNECTION SCREW TERMINALS 16

21.0 APPENDIX 8: LED OPERATION & ERROR INDICATORS 17

22.0 APPENDIX 9 - DMX512 DIGITAL DATA TRANSMISSION 18

1.0 DESCRIPTION

The TS Dimmers - designed and manufactured in Melbourne, Australia by L.S.C. Electronics Pty. Ltd. - provides either 12 channels of 10 or 12 Amp or 6 channels of 20 or 25 Amps. Each channel is protected by a fast acting MCB (Miniature Circuit Breaker). The TS Dimmer incorporates *Current Control Technology* to minimise any nuisance tripping from high inrush currents.

The TS Dimmer offers 6 different dimmer response curves per phase. These can be selected by the user via dip switches mounted on the front panel. See Section 9 Page 9 for further information.

The TS Dimmer accepts a multiplexed Digital control signal, DMX512 and as an option can also accept analog 0 to 10 Volts (positive or negative). If DMX512 and analog signals are received simultaneously they will operate on highest takes precedence.

The DMX512 start address is set by three easy to read rotary switches which allow a discrete address to be set between 001 and 512.

The unique high density construction of the TS Dimmer means that it is ideal for use "on the road" or installations. The TS Dimmer is supplied complete with 19 inch rack mount ears and is three rack units high (132mm).

The TS Dimmer is fitted with integral variable speed cooling to allow 100% duty cycle operation. Internal dimmer temperature can be monitored via an output connector on the rear panel.

Useful features include the ability to bring up any single channel or all 12 channels, for testing or for focusing, in 10% increments between 0 and Full without connecting a control desk. The "channel latch" function enables a scene to be set up, again without using a desk, for static display, preheat or emergency back-up.

An LED Output Display provides a mimic of channels currently in operation and also indicates a tripped MCB or phase failure.

Two LEDs give a real time indication of rack and DMX error status.

Three in-built chase patterns are also available.

The operator can choose from any of four available fade curves. A different fade curve may be used for the channels on each phase of power.

2.0 TECHNICAL SPECIFICATIONS

- 12 (6) Channels.
- 12 Amps (25 Amps) Max per Channel.
- Power Supply: nominal three phase 240/415 Volt 50/60Hz,50 Amp (max.) per phase. The dimmer will also operate on 110/208 Volts 50/60Hz 50 Amps Max . This supply must be fused, isolated and have a full rated neutral.
- Single phase operation is also possible but requires factory modification. Please contact your distributor for details.
- 12 (6) MCBs are fitted to the front panel for channel protection.
- 2? x 3AG fuses are fitted for control and fans.
- 2 x 120mm cooling fans are fitted internally to the dimmer to allow for 100% duty cycle operation. These fans will automatically vary their speed according to internal rack temperature
- Remote monitoring of internal temperature and over temperature indication via DB9 mounted on rear panel.
- 12 x LED indicators show when channels are being driven, if a MCB has tripped or phase failure.
- LED indicators also indicate the status of the Dimmer and the DMX512 input.
- Channel Select and Rate switches allow testing of any channel at 10% steps between 0 and Full.
- Optional scene memory available that allows a scene to be built with out the need of a desk.
- Chase patterns available without connecting desk to rack.
- 4 User selectable fade curves, selectable per phase.
- Standard 19" Rack mountable (3 Units high).
- Quality toroidal inductors ensure high RF suppression.
- Microprocessor based operation.

ANALOG (optional)

- Control Voltage 0 to +/- 10 Volts with automatic selection.
- Control connection: DB15 male connector located on rear panel.
- Analog and digital signals if used simultaneously operate in highest take precedence.

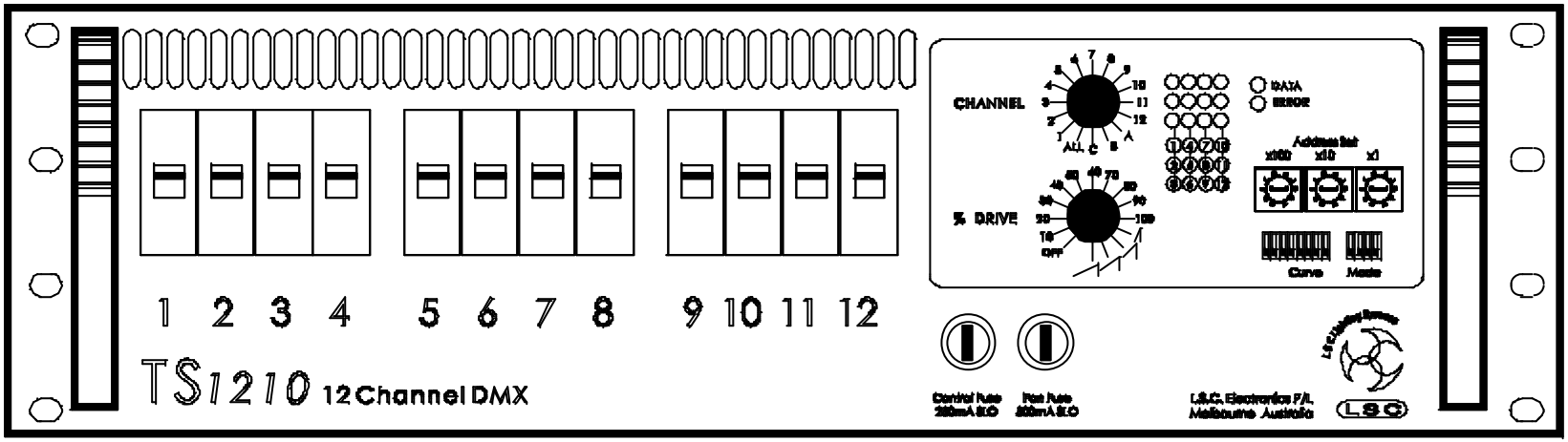
DIGITAL

- 485 (EIA-422) Communications Link. Accepts DMX512
- Control connection: rear mounted 5 pin Male XLR microphone style connector.
- Link to further dimmers via rear mounted 5 pin Female XLR microphone style connector.
- Three Address switches enable starting address of each dimmer to be set between 1 and 999 (1 to 512 are valid DMX512 address).

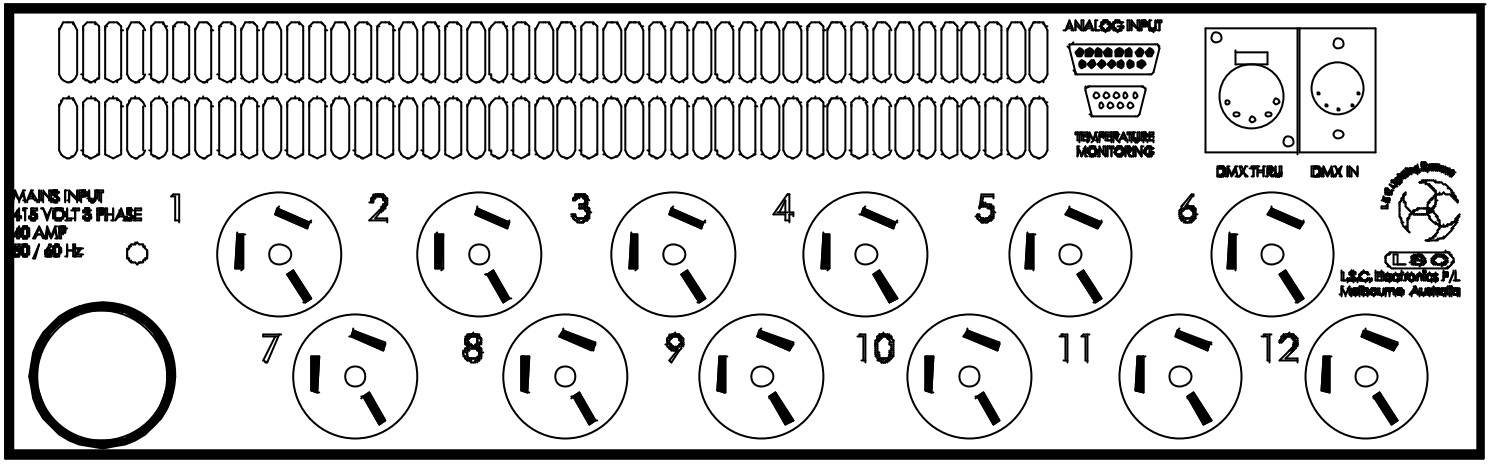
Dimensions
- 430mm x 420mm x 132mm

Construction
- Constructed from zinc steel. Chassis is finished in black baked powder coat.
- The Front panel is a self adhesive rear screen printed lexan decal.

Weight
- 28kg



FRONT VIEW



REAR VIEW

Shown with Australian 3 pin connectors

3.0 WIRING

3.1 Input Supply

The TS Dimmer is designed to be connected to a 240/415 Volt three phase supply rated at 40 Amp per phase. Input power connection is provided by six 10 mm^2 terminal blocks located within the cabinet. The connections provided by this block are shown in the diagram below.

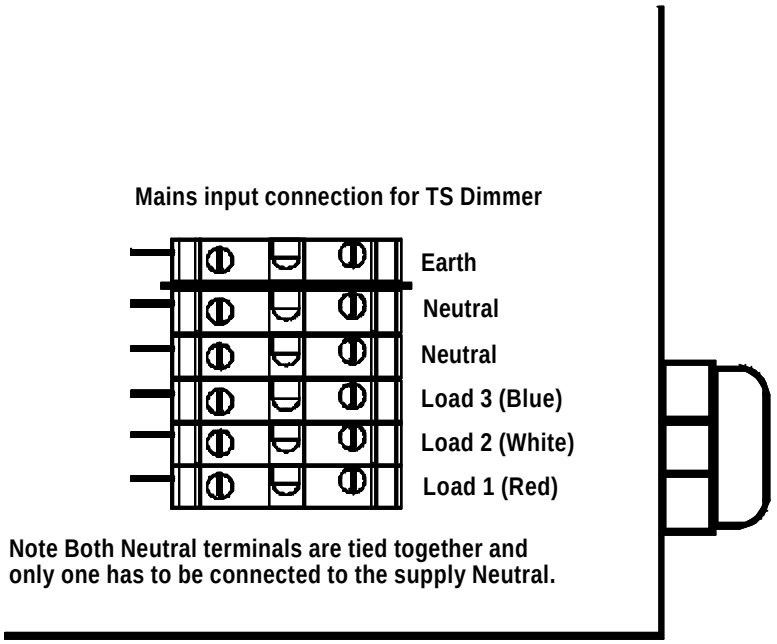
Please note that it is essential for a neutral to be provided in order to avoid damage to the dimmer and loads.

If for any reason the second or third phase of power is not reaching the dimmer rack then the LED Display will show this by flashing all four LEDs on the second or third power phase. If two power phases are not reaching the dimmer rack then the LED Display will show this by flashing all eight LEDs associated with those two phases. LED status indications are listed at Appendix 8 on page 18. As the TS Dimmer draws power for its internal electronics from the First Phase, the rack will not function if power from this phase is not reaching the dimmer.

A thermistor thermal cut out device is used to protect the TS Dimmer from overheating. This will reset itself once normal operating temperature has been achieved.

Power entry is via a 32mm hole located at the rear of the dimmer.

Fig. 1. Mains Input Termination.



Note: For Single phase operation both the Neutral and single Active terminal will accept 35mm^2 cable. During Single phase operation the Neutral current can be as high as 120 Amps. This version should be specified at time of ordering. If you wish to convert an existing unit please contact LSC for advice.

3.2 Control Wiring - Analog input (optional)

Connection from the control desk to the dimmer is made via a DB15 male connector mounted on the rear panel. The Common terminal is floating and not referenced to earth, this will minimise any earth loop problems that may occur. The pin connections are listed in Appendix 1 on page 13.

3.3 Control Wiring - Digital Dimmers

In compliance with the specifications of DMX512 connection from the control desk to the Dimmer is made via a male 5 pin XLR microphone style connector. The pin connections for these are listed in Appendix 2 on page 14. A female 5 pin XLR microphone style connector is provided to enable linking of further DMX512 based products.

3.4 Remote Temperature Monitoring

The TS Dimmer has a remote temperature and over temperature monitoring system fitted as standard. This allows the internal rack temperature to be monitored at a remote location. A DB9 female connector is located on the rear of the dimmer and a voltage proportional to the internal temperature (0.1V/^{o}C ie 25^{o}C = 2.5V) and a relay contact closure for over temperature appears on it. See Appendix 3 on page 15.

The internals of the dimmer a based on 2 heat sink assemblies each with 6 (3) channels fitted. Each of these heat sinks has its own temperature monitoring and fan drive circuit. As the temperature of a heat sink rises the fan speed will be increased, which inturn forces more air over the heat sink increasing its cooling ability.

The over temperature indication will be activated when either heat sink reaches approximately 105^{o}C. At this stage the dimmer will shut down until the rack cools to 80^{o}C. A contact closure on the DB9 connector gives an indication of over temperature status.

See Appendix 3 on page 15 for pin connections.

3.5 Load Connection

Five load connection options are available on the rear panel:

Option 1: Australian Standard Sockets.
Twelve (6) 3 pin 240 Volt sockets, one for each channel, are provided on the rear panel of the Dimmer. Connection to these sockets should be made using standard 3 pin plug tops and 10 (20) Amp rated 3 core cable.

Option 2: Socapex 419 AR 19-Pin Sockets.
Two Socapex 419 AR 19 pin sockets are provided on the rear panel of the Dimmer. The first connector is for channels 1 to 6, the second is for channels 7 to 12. Pin connections are listed in Appendix 4 on page 15.

Option 3: Wieland or Harting Connectors.
Two 16-pin Wieland or Harting sockets are provided on the rear panel of the Dimmer. The first connector is for channels 1 to 6, the second is for channels 7 to 12. Pin connections are listed in Appendix 5 on page 16. The socket housings are supplied with locking levers. Not available on 20, 25 Amp models.

Option 4: Wieland or Harting Connectors.
Three 10-pin Wieland or Harting sockets are provided on the rear panel of the Dimmer. The first connector is for channels 1 to 4, the second is for channels 5 to 8 and the third is 9 to 12. Pin connections are listed in Appendix 6 on page 16. The socket housings are supplied with locking levers. Not available on 20, 25 Amp models.

Option 5: Screw Terminal.
A row of 4mm^{2} DIN rail terminals is supplied , providing Active, Neutral and Earth terminations for each channel. Pin connections are listed in Appendix 7 on page 17.

4.0 OVER LOAD PROTECTION

A total of 12 (6) MCBs and 2 fuses are provided for the protection of external loads, wiring, fans and control electronics.

Twelve (6) MCBs are provided on the front panel, one for each of the output circuits. These MCBs are rated at 10 or 12 Amps (20 or 25 Amps)

When a MCB has tripped it will be indicated by a double flash on the appropriate LED in the LED output Display. See Appendix 8 on page 18 for a full list of LED status indications.

Two further fuses, located on the front panel of the unit, provide protection for the internal electronics and cooling fans. This glass fuse is a 3AG type rated at 0.5 Amp for the fans and 0.25 Amp for the electronics and should normally never need replacing. If however this fuse blows consistently, an internal problem is likely and qualified assistance should be sought.

Please ensure that all fuses are securely fixed in their holders before use as vibration in transit may have loosened them.

5.0 MOUNTING

Your TS Dimmer has been designed to be used free standing or to be rack mounted and is supplied with integral rack mounting ears.

When installing the unit, be sure not to obstruct the ventilation slots on each unit. To ensure adequate ventilation ensure that air flow from the rear of the dimmer is not obstructed. Cool air is drawn from the front through the MCBs and exhausted out the rear of the dimmer. If the Dimmers are installed in a closed cabinet ensure that sufficient ventilation is provided in the cabinet.

6.0 TRIMMING - (Analog option only)

The intelligent, up to date circuitry of your TS Dimmer can accept either a positive or negative analog control signal and a wide range of control voltage levels. The polarity selection is automatic and the Dimmer Pack is adjusted for a nominal 0 to 10 Volt maximum control signal, when shipped from the factory.

Trim controls are provided for Top-end and Bottom-end level adjustments. These trim pots are situated in the right-hand corner on the front of the unit and are accessed by removing the whole front panel. The bottom set is the left hand pot and the top set is the right hand pot (as viewed from the front).

7.0 THE CHANNEL SELECT FUNCTION

To bring up a channel without having to connect a control desk, first select the Channel Number via the Channel Select Knob (note that the "ALL" setting brings up all 12 channels) then select the level using the % Drive Knob.

In addition to the level settings at 10% intervals between 0 and Full there are four "Ramp" settings. These allow a selected channel to fade slowly up to Full and then snap to 0. Each of the four positions has a different speed setting for the fade time.

7.1 The Channel Latch Function

A special "channel latch" function has been added to the TS Dimmers. This offers the ability to use the Channel Select and % Drive Knobs to dial up a "scene". If this facility is required then switch number 7 on the Fade Curve Select switches must be in the ON position. (These switches are located on the right hand side on the front. The on position is achieved by pushing the switch to the up position)

Once this function has been selected the Channel Select and % Drive Knobs are used in the normal way to call up an output from a specified channel. When a new channel is selected via the Channel Select Knob the setting for the old channel will be maintained. It is, therefore, possible to move through from Channel 1 to Channel 12 creating a setting for each channel. A mimic level of the channel drive will be displayed on the channel drive LEDs. See Appendix 8 on page 17 for a full list of LED status indications.

Once a setting has been made it can be turned off by moving fade curve select switch Number 7 to the OFF position. As long as the power to the dimmer hasn't been turned off the scene can be restored by moving fade curve select switch Number 7 to the ON position.

Unless you have the optional "Scene Memory Storage" (see Section 12 on Page 12) facility settings are lost when power to the dimmer is turned off.

Dip 8 switch 7	Function
OFF	Channel Latch function is OFF.
ON	Channel Latch function is ON.

8.0 THE CHASE FUNCTION

Without connecting the TS Dimmer to a control desk it is possible to obtain three different Chase Patterns. These are obtained by setting the Channel Select Knob into either the A, B or C positions. The % Drive Knob then becomes a speed control for these Chase Patterns.

The three standard Chase Patterns are as follows:-

A. A 12 step chase progressing from Channel 1 to Channel 12.

B. A 4 step chase using channels 1, 2 & 3 as step one, channels 4, 5, & 6 as step 2, channels 7, 8, & 9 as step 3 and channels 10, 11, & 12 as step 4.

C. A random chase using all channels.

The "Ramp" positions on the % Drive Knob cause the Chase Speed to gradually increase until it reaches its maximum and then snap back to the slowest speed. Experimentation here can produce some interesting effects particularly with the random chase.

9.00 SELECTING FADE CURVES

Four fade curves are available in each TS Dimmer :-
S LAW, SQUARE LAW, CUBE LAW and QUAD LAW. These are selected via switches 1 to 6 of the Fade Curve Select Switches. (Located on the right hand side of the front panel).

The 120 VOLT curve - is primarily for use with Par 64 lanterns. The curve incorporated is an S curve and approximates the same fade as 2 Par 64's in Series using the 240 Volt S curve. To activate the 120 Volt fade curve set switch 2 of the four way dip switch on and select Quad Law on the 8 way dip switch.

Please note that only one Par 64 can be connected to each dimmer channel when the 120 VOLT curve is used. Care must be taken that the dimmer is fitted with the 120 VOLT curve and that the correct curve is selected for all relevant channels. In all cases L.S.C. ELECTRONICS Pty. Ltd. takes no responsibility for damage to lamps operated in this manner.

See page 10 for dip switch setup table.

Fade Curve Select Switch Settings

THE FIRST PHASE

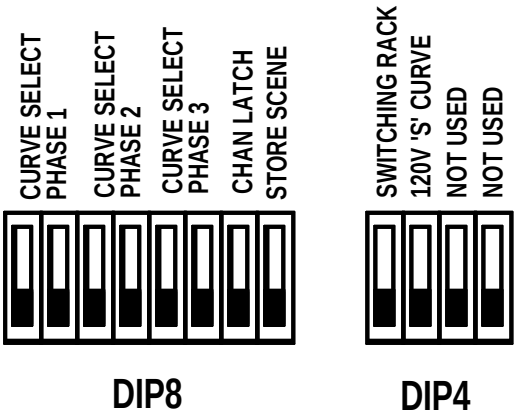
Channels	Dip 8 Switch 1	Switch 2	Dip 4 Switch 2	Function
1,4,7 & 10	OFF	OFF	OFF	S Curve
1,4,7 & 10	OFF	ON	OFF	Square Law
1,4,7 & 10	ON	OFF	OFF	Cube Law
1,4,7 & 10	ON	ON	OFF	Quad Law
1,4,7 & 10	ON	ON	ON	120 V S Curve

THE SECOND PHASE

Channels	Dip 8 Switch 3	Switch 4	Dip 4 Switch 2	Function
2,5,8 & 11	OFF	OFF	OFF	S Curve
2,5,8 & 11	OFF	ON	OFF	Square Law
2,5,8 & 11	ON	OFF	OFF	Cube Law
2,5,8 & 11	ON	ON	OFF	Quad Law
2,5,8 & 11	ON	ON	ON	120 V S Curve

THE THIRD PHASE

Channels	Dip 8 Switch 5	Switch 6	Dip 4 Switch 2	Function
3,6,9 & 12	OFF	OFF	OFF	S Curve
3,6,9 & 12	OFF	ON	OFF	Square Law
3,6,9 & 12	ON	OFF	OFF	Cube Law
3,6,9 & 12	ON	ON	OFF	Quad Law
3,6,9 & 12	ON	ON	ON	120 V S Curve



Note: See Section 13 Page 12 for further detail on Switching Rack operation.

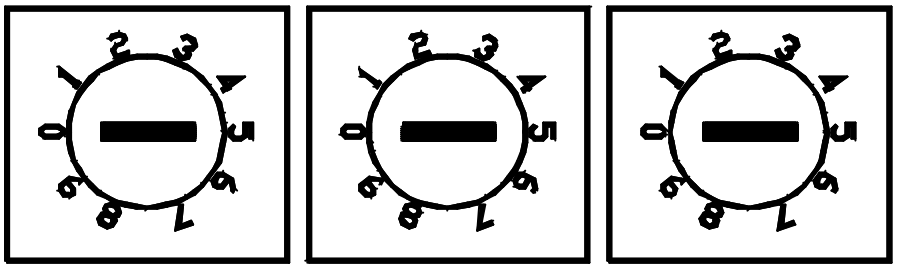
10.0 THE ADDRESS SETTINGS

On the front panel of the TS Dimmers there are three switches, each allowing the selection of a number between 0 and 9. These are the address switches.

Address switches are used because the digital signal contains information for a large number of channels (DMX512 protocol allows for 512 channels) and any one TS Digital Dimmer can only deal with 12 (6) of them. Hence it is necessary to select which 12 (6) will be relevant. For example if an address of 001 is selected then that dimmer will respond to control desk channels 1 to 12 (6). If an address of 152 is selected that dimmer will respond to desk channels 152 to 163 (157).

The TS Dimmer allows for an address setting of 999 to be set of which only 001 to 512 are valid for DMX512. Dimmer addresses can be overlapped ie more than one dimmer may be responding to the same group of control channels

The table below gives some common address settings. Most of the time a group of dimmers may be addressed sequentially from address 1 up wards in groups of 12. Some times the dimmers address is referred to as a Bank address. An example of these bank numbers are listed below.



Address setting	Responds to control channels	Bank Number
0 0 1	1 to 12	1
0 1 3	13 to 24	2
0 2 5	25 to 36	3
0 3 7	37 to 48	4
0 4 9	49 to 60	5
0 6 1	61 to 72	6
0 7 3	73 to 84	7
0 8 5	85 to 96	8
0 9 7	97 to 108	9
1 0 9	109 to 120	10
1 2 1	121 to 132	11
1 3 3	133 to 144	12

Note: If an address of 000 is selected the dimmer is effectively turned off and the red error LED will double flash to indicate this. See Appendix 8 on page 18 for a full list of LED status indications.

11.0 PROTOCOLS AND BAUD RATES

The TS Dimmer has been designed primarily for use with equipment using the DMX512 digital data transmission standard (see Appendix 9 on page 19). This international standard deals with connectors, cable, maximum numbers of dimmers, protocols and baud rates.

12.0 SCENE MEMORY STORAGE OPTION

To operate first set a scene using either the Channel Latch Function (see Section 7.01 on Page 8) or by using a control desk connected to the input. Moving Fade Curve Select switch 7 to ON and toggling switch 8 from OFF to ON to OFF to store the output of the dimmer.

Please note that leaving the Fade Curve Select Switches 7 and 8 in the On position will not mean that any subsequent changes are saved as the settings will only be read at the moment that Switch 8 is moved from OFF to ON. Switch 8 should then be returned to OFF ready for the next operation.

Once a scene has been saved it will be held in memory even when power to the dimmer is turned off.

To replay the stored memory Fade Curve select switch 7 should be in the ON position.

Dip 8 Switch 7	**Dip 8 Switch 8**	**Function**
ON	OFF	Channel latch mode (see page 7)
ON	OFF-ON-OFF	Current output of dimmer saved
ON	OFF	Saved output replayed
OFF	ON	No effect

13.0 SWITCHING OUTPUT

The TS output can be changed from being a dimmable channel to being a switched all relay type output. Switched output is used for driving motors or similar type loads. To activate switching output, select switch 1 of the four way dip switch to on. The switching levels are 60% to turn the output on and 40% to turn the output off. These different thresholds provide a degree of hysteresis, which minimise channels chattering when the channel level is set to 60%.

Dip 4 Switch 1	**Function**
ON	All 12 channels will operate as non dim. i.e. Switched

14.0 APPENDIX 1: Control Cable and Plug Connections - Analog Option

DB15 Male

Pin	Function
1	Channel 1 analog input
2	Channel 2 analog input
3	Channel 3 analog input
4	Channel 4 analog input
5	Channel 5 analog input
6	Channel 6 analog input
7	Channel 7 analog input
8	Channel 8 analog input
9	Channel 9 analog input
10	Channel 10 analog input
11	Channel 11 analog input
12	Channel 12 analog input
13	Not used
14	Not used
15	Common (0 Volt reference)

15.0 APPENDIX 2: Control Cable and Plug Connections – DMX512.

The following is an extract from the specifications as laid down in the DMX512 standard (see Appendix 9 on page 18):-

9.0 CONNECTORS

Where connectors are used, the data link shall utilise 5-pin "XLR/AXR" style microphone connectors. Some manufacturers of this connector are:

Switchcraft
Neutrik

9.1 Connector Sex

Female connectors shall be utilised on controllers or other transmitting devices and male connectors shall be utilised on dimmers and other receiving devices. In cases where an optional second data link is implemented using the spare
pins of the connector for directional transmission, female connectors shall still be utilised on the controller.

9.2 Connector Pin Designation

Connector Pin Designations shall be as follows:

Connector Pin	**Function**
Pin 1	Signal Common – Shield or cable screen
Pin 2	Dimmer Drive Complement (Data 1 Negative)
Pin 3	Dimmer Drive True (Data 1 Positive)
Pin 4	Dimmer Drive Compliment (Data 2 Negative)
Pin 5	Dimmer Drive True (Data 2 Positive)

10.0 CABLE

Cable shall be shielded twisted pair approved for EIA422/EIA485 use.

Available from L.S.C. Electronics or our representatives.

16.0 APPENDIX 3: Pin Details For Temperature Connector

Pin Connection Details for Remote temperature and over temperature monitoring connector.

DB 9 Female

Pin	Function
1	Relay Common
2	Relay N/C
3	Chan 1-6 (1-3) Heat Sink temperature output.
4	Chan 7-12 (4-6) Heat Sink temperature output.
5	Common
6	Relay N/O
7	Not used
8	Not used
9	Not used

Note: Heat Sink temperature monitoring output is rated at 0.1V/^{o}C ie 25^{o}C = 2.5V

17.0 APPENDIX 4: Pin Details For Socapex 19 Pin Connectors

Pin Connection Details for Socapex 19 Pin Connectors

Connector 1	Function	Connector 2	Function
Pin 1	Chan 1 Active	Pin 1	Chan 7 Active
Pin 2	Chan 1 Neutral	Pin 2	Chan 7 Neutral
Pin 3	Chan 2 Active	Pin 3	Chan 8 Active
Pin 4	Chan 2 Neutral	Pin 4	Chan 8 Neutral
Pin 5	Chan 3 Active	Pin 5	Chan 9 Active
Pin 6	Chan 3 Neutral	Pin 6	Chan 9 Neutral
Pin 7	Chan 4 Active	Pin 7	Chan 10 Active
Pin 8	Chan 4 Neutral	Pin 8	Chan 10 Neutral
Pin 9	Chan 5 Active	Pin 9	Chan 11 Active
Pin 10	Chan 5 Neutral	Pin 10	Chan 11 Neutral
Pin 11	Chan 6 Active	Pin 11	Chan 12 Active
Pin 12	Chan 6 Neutral	Pin 12	Chan 12 Neutral
Pin 13	Earth	Pin 13	Earth
Pin 14	Earth	Pin 14	Earth
Pin 15	Earth	Pin 15	Earth
Pin 16	Earth	Pin 16	Earth
Pin 17	Earth	Pin 17	Earth
Pin 18	Earth	Pin 18	Earth
Pin 19	Spare	Pin 19	Spare

Note: Only connector 1 is fitted to 20 or 25 Amp (6 channel) models

18.0 APPENDIX 5: Pin Details For Wieland & Harting 16 Pin Connectors

Pin Connection Details for Wieland and Harting 16 Pin Connectors.

Connector 1	Function	Connector 2	Function
Pin 1	Chan 1 Active	Pin 1	Chan 7 Active
Pin 2	Chan 2 Active	Pin 2	Chan 8 Active
Pin 3	Chan 3 Active	Pin 3	Chan 9 Active
Pin 4	Chan 4 Active	Pin 4	Chan 10 Active
Pin 5	Chan 5 Active	Pin 5	Chan 11 Active
Pin 6	Chan 6 Active	Pin 6	Chan 12 Active
Pin 7	Not used	Pin 7	Not used
Pin 8	Not used	Pin 8	Not used
Pin 9	Chan 1 Neutral	Pin 9	Chan 7 Neutral
Pin 10	Chan 2 Neutral	Pin 10	Chan 8 Neutral
Pin 11	Chan 3 Neutral	Pin 11	Chan 9 Neutral
Pin 12	Chan 4 Neutral	Pin 12	Chan 10 Neutral
Pin 13	Chan 5 Neutral	Pin 13	Chan 11 Neutral
Pin 14	Chan 6 Neutral	Pin 14	Chan 12 Neutral
Pin 15	Not used	Pin 15	Not used
Pin 16	Not used	Pin 16	Not used

Note: Earth connection is via a clip on the side of the socket insert.
This connector is not available for 20 or 25 Amp (6 channel) models

19.0 APPENDIX 6: Pin Details For Wieland & Harting 10 Pin Connectors

Pin Connection Details for Wieland and Harting 10 Pin Connectors.

Connector 1	Function	Connector 2	Function	Connector 3	Function
Pin 1	Chan 1 Active	Pin 1	Chan 5 Active	Pin 1	Chan 9 Active
Pin 2	Chan 1 Neutral	Pin 2	Chan 5 Neutral	Pin 2	Chan 9 Neutral
Pin 3	Chan 2 Active	Pin 3	Chan 6 Active	Pin 3	Chan 10 Active
Pin 4	Chan 2 Neutral	Pin 4	Chan 6 Neutral	Pin 4	Chan 10 Neutral
Pin 5	Chan 3 Active	Pin 5	Chan 7 Active	Pin 5	Chan 11 Active
Pin 6	Chan 3 Neutral	Pin 6	Chan 7 Neutral	Pin 6	Chan 11 Neutral
Pin 7	Chan 4 Active	Pin 7	Chan 8 Active	Pin 7	Chan 12 Active
Pin 8	Chan 4 Neutral	Pin 8	Chan 8 Neutral	Pin 8	Chan 12 Neutral
Pin 9	Earth	Pin 9	Earth	Pin 9	Earth
Pin 10	Earth	Pin 10	Earth	Pin 10	Earth

Note: This connector is not available for 20 or 25 Amp (6 channel) models

20.0 APPENDIX 7: Pin Connection Screw Terminals

LABEL	COLOUR	FUNCTION	LABEL	COLOUR	FUNCTION
L1	GREY	Chan 1 Active	L7	GREY	Chan 7 Active
N1	BLUE	Chan 1 Neutral	N7	BLUE	Chan 7 Neutral
E1	GREEN/YELLOW	Chan 1 Earth	E7	GREEN/YELLOW	Chan 7 Earth
L2	GREY	Chan 2 Active	L8	GREY	Chan 8 Active
N2	BLUE	Chan 2 Neutral	N8	BLUE	Chan 8 Neutral
E2	GREEN/YELLOW	Chan 2 Earth	E8	GREEN/YELLOW	Chan 8 Earth
L3	GREY	Chan 3 Active	L9	GREY	Chan 9 Active
N3	BLUE	Chan 3 Neutral	N9	BLUE	Chan 9 Neutral
E3	GREEN/YELLOW	Chan 3 Earth	E9	GREEN/YELLOW	Chan 9 Earth
L4	GREY	Chan 4 Active	L10	GREY	Chan 10 Active
N4	BLUE	Chan 4 Neutral	N10	BLUE	Chan 10 Neutral
E4	GREEN/YELLOW	Chan 4 Earth	E10	GREEN/YELLOW	Chan 10 Earth
L5	GREY	Chan 5 Active	L11	GREY	Chan 11 Active
N5	BLUE	Chan 5 Neutral	N11	BLUE	Chan 11 Neutral
E5	GREEN/YELLOW	Chan 5 Earth	E11	GREEN/YELLOW	Chan 11 Earth
L6	GREY	Chan 6 Active	L12	GREY	Chan 12 Active
N6	BLUE	Chan 6 Neutral	N12	BLUE	Chan 12 Neutral
E6	GREEN/YELLOW	Chan 6 Earth	E12	GREEN/YELLOW	Chan 12 Earth

Note: Only Terminal L1 through to E6 are fitted to 20 or 25 Amp (6 channel) models

21.0 APPENDIX 8: LED Operation & Error Indicators

Led	Indication	Reason	Remedy
Chan 1 – 12	Solid 0 to 100%	Normal indication of Channel drive	Normal operation
Chan 1 – 12 No DMX applied	Solid 0 to 100%	Channel Latch or Scene replay enabled See section 7 or Section 12	Normal operation
Chan 1 – 12	Double Flash	Channel MCB Tripped	Reset Channel MCB
Chan 1,4,7&10	Single Flash	Phase 1 failed	Check phase 1 and correct
Chan 2,5,8&11	Single Flash	Phase 2 failed	Check phase 2 and correct
Chan 3,6,9&12	Single Flash	Phase 3 failed	Check phase 3 and correct
Data (Green)	Solid	DMX512 received and good. At least one channel within the dimmer's address range is been driven by the DMX signal.	Normal operation
Data (Green)	Flashing (may be random)	DMX512 received and good. No channels within the dimmer's address range are been driven by the DMX signal.	Normal operation. Some consoles do not produce 512 channels of information or do not send every packet with 512 channels of information.
Error (Red)	Solid	Bad DMX512. The dimmer is receiving bad, corrupted or non spec DMX512 data.	Check cabling and DMX512 signal for compliance to USITT standard.
Error (Red)	Flashing (may be random)	The dimmer has received a bad packet of DMX512. ie only a few bits of data have been corrupted.	Check cabling and DMX512 signal for compliance to USITT standard.
Error (Red)	Double Flash	Address switch set to 000	Set valid DMX start address

22.0 APPENDIX 9 - DMX512 DIGITAL DATA TRANSMISSION

1.0 SCOPE

This Standard describes a method of digital data transmission between controllers and dimmers. It covers electrical characteristics, data format, data protocol, connector type, and cable type.

2.0 APPLICABILITY

This standard is intended as a guide for:

1. Equipment manufacturers and system specifiers who wish to integrate systems of dimmers and controllers made by different manufacturers.

2. Equipment manufacturers seeking to adopt a basic controller-dimmer digital transmission protocol.

Although widespread adoption of this standard is sought by USITT, compliance with the standard is strictly voluntary. Furthermore, it is not intended as a replacement for existing protocols already manufactured, but rather as an addition to existing protocols which will broaden the installed base of controllers and dimmers that can communicate with each other.

3.0 CROSS REFERENCE

See EIA standards EIA-422A and EIA-485 available from:

Electronic Industries Association
Standards Sales Office
2001 Eye Street NW
Washington DC 20006
Ph. 202-457-4900

4.0 ELECTRICAL SPECIFICATIONS

The standard shall follow EIA Standards EIA-485 (an enhanced version of EIA-422A) with regard to all electrical characteristics including line driver and receiver selection, line loading, and multi-drop configurations.

4.1 Common Mode Voltages

Equipment designers are advised to pay particular attention to the Common Mode voltage provision of EIA-485 in the choice of transmitter and receiver components and general system implementation.

4.2 Electrical Isolation

This Standard and EIA-485 make no general provisions for electrical isolation. However, suitable optical isolation, transformer isolation, or other means may be employed to prevent the undesirable propagation of voltages which exceed the Common Mode limits of EIA-485. The inclusion of such general isolation does not, however, alter the requirement that a transmitter or receiver conform to EIA-485.

5.0 DATA PROTOCOL

Data transmitted shall be in asynchronous serial format. Dimmer level data shall be transmitted sequentially beginning with dimmer 1 and ending with the last implemented dimmer, up to a maximum of 512. Prior to the first level transmitted, a RESET signal shall be transmitted followed by a NULL START code. Valid dimmer levels shall be 0 to 255 decimal (00 to FF hexadecimal) representing dimmer control input levels of OFF to FULL in a linear relationship. These numeric values shall not necessarily have any relationship to actual dimmer output, which shall be determined within the dimmer itself.

5.1 RESET SIGNAL

The RESET signal (Timing Diagram Designation #1) shall consist of a BREAK lasting 88 ?Seconds (two frame times) or any longer duration. A BREAK shall be defined as a high-to-low transition followed by a low of at least 88 ?Seconds. All dimmers and other receiving devices shall interpret any such BREAK as a terminator for any pending transmission/data packet and its end as the start of the MARK AFTER BREAK and START code sequence at the beginning of the next packet.

5.1.1 Mark After Break

The duration of the MARK that separates the RESET/BREAK and the START code (Timing Diagram Designation #2) shall be not less than 8 ?Seconds nor greater than 1 Second. All DMX512/1990 transmitters shall produce a MARK AFTER BREAK of not less than 8 ?Seconds. All receivers shall recognise a MARK AFTER BREAK of minimum 8 ?Seconds. receivers also capable of recognising the shorter 4 ?Seconds MARK AFTER BREAK specified in the 1986 DMX512 specification and produced by some transmitters in the field may be so identified and marked as per Paragraph 11.0

5.2 Null Start Code

The NULL START code shall be defined as a properly framed NULL character (all zeros) following a RESET. The NULL START code is the data packet identifier which identifies subsequent data as sequential dimmer level
information.

5..3 Other Optional Start Codes

In order to provide for future expansion and flexibility in controlling devices other than dimmers, this standard makes provision for 255 additional START codes (1 through 255 decimal, 01 through FF hexadecimal). For this reason, a dimmer receiver must not accept as 8-bit level data, any data packet with a START code other than a NULL START following the RESET.

5.4 Maximum Number Of Dimmers

Each data link shall support up to 512 dimmers. Multiple links shall be used where larger numbers of dimmers are required.

5.5 Minimum Number Of Dimmers

There shall be no minimum number of dimmers on the data link. DMX512 data packets with levels for less than 512 dimmers may be transmitted, provided that the conditions of this Standard, including Paragraphs 5.0 and 5.0.8 are observed.

5.6 Defined Line Between Frames

The time between any two frames of a data packet (Timing Diagram Designation#8) may vary between 0 ?Seconds and 1 Second. The line must remain in the "marking" state during any such idle period greater than 0 ?Seconds. A receiver must be capable of accepting a data packet having no idle time (0 ?Seconds) between any of its frames.

5.7 Defined Line State Between Data Packets

Regardless of START code or length, every data packet transmitted on the data link must begin with a RESET, MARK AFTER BREAK and START code sequence as defined above. The time between the second stop bit

of the last data byte/frame of one data packet and the falling edge of the beginning of the RESET for the next data packet (Timing Diagram Designation #9) may vary between 0 ?Seconds and 1 Second. The line must remain in an idle ("marking") state throughout any such period greater than 0 ?Seconds. Transmitters, therefore, may not produce multiple BREAKs between data packets. Receivers must, however, be capable of recovering from multiple BREAKs produced by data line errors.

5.8 MINIMUM BREAK SPACING

The period between the falling edge at the start of any one BREAK shall be not less than 1196 ?Seconds from the falling edge at the start of the next BREAK.

6.0 DATA FORMAT

The data transmission format for each level transmitted shall be as follows:

BIT POSITION	DESCRIPTION
1	Start Bit, Low or SPACE
2 -9	Dimmer level Data Bits, Least Significant Bit to Most Significant Bit, Positive Logic.
10,11	Stop bits. High or MARK
Parity	Not transmitted

7.0 DATA RATE

The data rate and associated timing shall be as follows:

Data Rate:	250 Kilobits per second
Bit time:	4.0 microseconds
Frame time:	44.0 microseconds
Maximum update:	22.71 milliseconds
Rate for 512 dimmers including RESET and START	4.03 times per second

7.1 TIMING DIAGRAM

DESIGNATION	DESCRIPTION	MIN	TYP	MAX	UNIT
1	"Space" for BREAK	88.00	88.00		?SEC
2	"Mark" between BREAK	8.00			?SEC
	and START code			1.00	SEC
3	Frame Time	43.12	44.00	44.88	?SEC
4	Start Bit	3.92	4.00	4.08	?SEC
5	Least Significant Data Bit	3.92	4.00	4.08	?SEC
6	Most Significant Data Bit	3.92	4.00	4.08	?SEC
7	Stop Bit	3.92	4.00	4.08	?SEC
8	"Mark" Time between Frames	0.00	0.00	1.00	SEC
9	"Mark" Tim e between Packets	0.00		1.00	SEC

8.0 LOSS OF DATA TOLERANCE

The receiving device must maintain, for a minimum of 1 Second, the last valid level received for each connected dimmer. Designers of transmitters are reminded that a low number of dimmer level (START CODE 00) updates may be interpreted by a receiver as loss of data.

8.1 RECEIVER DATA RATE TOLERANCE

DMX512/1990 is intended to make possible the interconnection of lighting control equipment by different manufacturers. It does not specify the minimum performance levels of connected equipment, either in terms of the number of updates per second produced by a transmitter, or by requiring that all level updates on the data link be used by receiving product.

The performance of any product incorporating a DMX512/1990 receiver must, however, not be degraded by the presence at its input of the continuous transmission of data packets containing any number of dimmer levels up to the maximum update rates specified in Section 5 Paragraph 7.0 above.

9.0 CONNECTORS

Where connectors are used, the data link shall utilise 5-pin "XLR" style microphone connectors. Some manufacturers of this connector are:

Switchcraft
Neutrik

9.1 CONNECTOR SEX

Female connectors shall be utilised on controllers or other transmitting devices and male connectors shall be utilised on dimmers and other receiving devices. In cases where an optional second data link is implemented using the spare pins of the connector for directional transmission, female connectors shall still be utilised on the controller.

9.2 CONNECTOR PIN DESIGNATION

Connector Pin Designations shall be as follows:

PIN 1 - Signal Common (Shield)
PIN 2 - Dimmer Drive Complement (Data 1 -)
PIN 3 - Dimmer Drive True (Data 1 +)
PIN 4 - Optional Second Data Link Complement (Data 2 -)
PIN 5 - Optional Second Data Link True (Data 2 +)

10.0 CABLE

Cable shall be shielded twisted pair approved for EIA-422/EIA-485 use. Examples of suitable cable are:
Belden 9841
Alpha 5271 (one pair, no spares provided)
Belden 9842
Alpha 5272 (two pairs, one as a spare)

11.0 MARKING AND IDENTIFICATION

Equipment conforming to this Standard may be marked "USITT DMX512/1990" or DMX512/1990".

Only receivers capable of accepting a 4uSecond MARK AFTER BREAK may be marked and identified as "USITT DMX512/1990 (4 ?Sec)" or "DMX512/1990 (4 ?Sec)".

Compliance with this Standard is the responsibility of the manufacturer, and such marking and identification does not constitute certification or approval by the USITT.