Operator Manual

Power Bar
distributed dimmers

Contents:

1 Introduction

1.1 Product range

This handbook describes the operation and programming for the IES 'Power Bar' range of IGBT dimmers incorporating 'itec' low-noise dimming technology. The dimmers covered by this handbook are

9906	PowerBar PB4-X 4 x 1250W, 22A single phase
2003	PowerBar PB4-2X 4 x 2.5kW, 44A single phase
9907	PowerBar PB6-2X 6 x 2,5kW, 22A three phase

1.2 New dimmer design

The PowerBar range of dimmers represents the most advanced dimming system available today. The advantages of IGBT dimming technology, as developed by IES into its 'itec' design, delivers low-noise, high power dimming capability with advanced electronic measurement and control to accommodate variations in the power supply and load conditions. The dimmers will automatically compensate for poor mains regulation, and will respond to a short-circuit condition faster than any mechanical protection device.

1.3 Distributed dimming

The high efficiency (low heat dissipation) of the dimmer circuit, combined with its compact design, electronic protection and sophisticated status reporting system, makes the PowerBar ideally suited to distributed dimming schemes where a central dimmer room is unavailable or undesirable.

1.4 Key features of itec system

The itec system from IES offers low noise dimming (both acoustic noise from lamp and dimmer as well as electrical interference are reduced), control of a wide range of load types, and sophisticated control options for the broadest range of lighting dimmer situations. Each dimmer channel can be individually programmed either at the dimmer itself, or remotely from a PC, and once programmed, the dimmer can operate simply and transparently whilst being protected against inadvertent adjustments. The PowerBar range of dimmers is compatible with all other IES dimmers including the Executive itec dimmer pack.

2 Unpacking and installation

2.1 Unpacking & checking

The PowerBar is self-contained and only requires mounting components (two hook clamps or 'C' clamps and a safety bond), plus a suitable mains input connector.
The PowerBar is packed to withstand normal transportation, but before operating the unit, check there is no sign of transit damage which could affect the operation and safety of the dimmer.

2.2 Positioning

The PowerBar is an extremely versatile dimmer, and can be located in a variety of positions. It is designed for natural cooling, hanging by two suspension clamps and care must be taken to ensure adequate ventilation around the case. Note that the full-power duty cycle is only possible if the PowerBar is suspended in free air. If it is used on the ground there may be insufficient ventilation for continuous service at full power. Should the PowerBar overheat in this condition, an internal detection circuit will report an overheat condition and will progressively turn-off power until a normal operating temperature has been reached.

2.3 Connections

> *Note: Fit a suitably-rated plug to the cable or connector supplied. All electrical connections to the PowerBar must be made by a suitably-qualified person.*

2.3.1 Power connections for PB4-X
A single-phase CEE17 32A is recommended. Output connections are 4 x CEE17 16A or Schuko.

2.3.2 Power connections for PM4-2X and PM2-5X
A single-phase CEE17 63A is recommended for full power applications for PB4-2X. Alternatively, a CEE17 32A may be used if the maximum current setting is reduced to 32A and an equivalent diversity factor is applied for the loads. Output connections are 4 x CEE17 16A for PM4-2X . Others are available on request.

2.3.3 Power connections for PB6-2X
Mains connections are made via Harting (or equivalent) 80A 3-phase multipole connectors (not supplied). Output connections are CEE17 16A. Others are available on request. (See note overleaf).

Note: The PB6-2X is a 3-phase dimmer unit which is equipped with a looping mains connection system comprising an input 80A Harting 3-phase input connector and a mating 80A output connector to enable up to three PM6-2X units to be connected in line to the same 63A 3-phase mains supply. When linking PowerBar together, do not exceed the maximum power rating of the interconnecting mains supply cables.

2.3.4 Power connections for PM1

The main supply connection requires a 63A single phase CEE17 line socket, and the output is a 63A single phase CEE17 socket.

2.3.5 DMX data signals

All PowerBars are controlled by DMX 512 connected by a two-pair and shield high-speed data cable with XLR 5-pin connectors (male = input; female = output).

Pin connections are:
`

2   DMX +

3   DMX -

4   DimSTAT -

5   DimSTAT +

The DMX network supports up to 32 PowerBars connected to one line. For larger installations where more DMX lines are required, the use of a DMX booster/isolator is recommended. Any booster/isolator used has to accommodate bi-directional data on pins 4 and 5 for DimSTAT to operate. Suitable boosters are IES code 9601 (5 channels) or 9815 (10 channels).

Termination is required for both DMX and DimSTAT data on all networks. The last DMX output socket in the line has to be terminated with two 120 1/4 Watt resistors connected between pins 2 and 3 (DMX) and between 4 and 5 (DimSTAT). A 'dummy plug' XLR male connector with the termination resistors fitted is recommended for this purpose.

2.4 Safety

Even though the PowerBar is equipped with the latest electronic safety protection features and in some cases an RCBO input protection device, all normal electrical safety procedures must be applied. Do not use the dimmer if the mains input cable has been damaged, or the body of the case is not intact.

3 Control panel layout

ON LED

Illuminates red when power is applied, and the RCBO or MCB is switched on.

DMX LED

Illuminates red continuously when valid DMX is present. LED flashes when there is no DMX signal.

ENT & cursor arrows

ENT (ENTer) completes a programming step and records the information in the memory
The four cursor arrows provide navigation through the set-up menu, and the means to enter data.

⬆ Up cursor. Higher level menu feature or move cursor up in display screen or number increment.

⬇ Down cursor. Lower level menu feature or move cursor down in display screen or number decrement

⬅ Left cursor. Move cursor left in display screen

➜ Right cursor. Move cursor right in display screen

DMX

Selects DMX address per channel.

INST

INSTall function. To set-up dimmer functionality options as follows:
- Line Voltage, frequency and current
- DimSTAT communication address
- DMX failure options
- DMX backup levels
- DMX configuration (individual or combined)
- Channel configuration (individual or combined)
- Sleep mode
- Voltage regulation
- Current limit
- Minimum level reset (preheat off when DMX is not present)
- Voltage calibration

- Factory reset
- Channel information
- Password set-up
- Dimmer hardware configuration

CHAS (with LED)

CHASe. Provides access to the dimmer's internal 20-pattern chase effects system for stand-alone display effects. The LED illuminates when the dimmer is in the 'chase' operation mode.

CONF

CONFigure. Access to a sub-menu to set the detailed configuration for individual or combined dimmer channels. Options available are:

MAX	MAXimum. Sets the maximum output level from 30% to 100%, individually or combined.
MIN	MINimum. Sets the minimum output level from 0% to 29.9%, individually or combined.
T-IN	Response time to fade in from 0.00 secs to 99.9 secs.
T-OUT	Response time to fade out from 0.00 secs to 99.9 secs.
CURVE	Dimmer law selection
NONDIM	I/O. On/off operation
PRIORITY	Priority channel (the last to be reduced if the maximum preset current is exceeded by the module).
PHASE	Phase OFF is IGBT normal mode, Phase ON is 'triac mode'
MODE	Start mode (normal, soft start, burst, proportional, blink)

MAN

MANual. Provides manual control of each channel for circuit testing and pre-setting.

EXIT

Returns to the opening screen menu option without recording changes.

INFO

INFOrmation. Provides a display of the nominal supply voltage, current and frequency. After 3 secs. also gives details of the installed software versions.

CHK (with LED)

ChecK. Displays a log of any circuit or dimmer faults. LED illuminates if an error occurs.

4 Function overview

4.1 Forward or reverse phase operation

For the lowest noise operation (filament noise and electrical noise) IGBT dimmers are usually operated in Reverse phase mode where the mains waveform rises naturally, and power is controlled by switching off during the half-cycle. For non-tungsten halogen loads, such as transformers, motors etc, Forward phase mode is recommended which is similar to the operation of a triac dimmer. Factory default is reverse phase operation.

> Note: Highly inductive loads **must** be controlled in Forward, phase-ON mode to avoid any risk of damage to the itec module.

4.2 Maximum and minimum levels

The maximum output of the dimmer may be adjusted to improve lamp life or to limit the power used. A minimum level (preheat) may be necessary with some filaments to improve the speed of fast flashes or chases. An option exists to switch off the preheat when the DMX signal is not present (i.e. when the control desk is switched off).

4.3 Response speed

The time taken for a dimmer to 'fade' to the applied control signal level is used to control the rate of change of current to the filament improve lamp life for higher wattage filaments.

4.4 Non-dim operation

Each dimmer may be selected to operate as a dimmer, or as a non-dim switch.

4.5 Local control

PowerModules have a range of integrated control facilities for basic operation without a control desk. These include live manual control of each dimmer level, preset recorded levels for fixed display lighting, and access to an in-built chaser which provides 20 chase patterns.

4.6 Dimmer curves

A selection of dimmer curve transfer functions (the relationship between from control signal level and dimmer output) are available to compensate for the different visual responses of a live audience or a TV camera, and to provide improved dimming for non-resistive loads such as fluorescent tubes.

4.7 Status reporting

All IES dimmers incorporate a bi-directional communications system called DimSTAT which provides feedback of the dimmer status and fault reporting to a PC. DimSTAT also enables a remote PC to control any dimmer in the network, and to update the dimmer's internal operating software and preset options.

4.8 Backup settings

Should the DMX signal fail, the PowerModule can be programmed to hold the present level, fade to zero or fade to a pre-programmed backup level.

5. Information displays and manual control

This group of buttons provides direct access to detailed set-up and status information and manual override controls, and do not require passwords for access.

5.1 To check power supply

1. Press PWR.
2. The screen shows:

```
U:242                    V
I: 00                    A
```

Where: U is the mains input voltage in Volts, I is the instantaneous load current in Amps (3 phases shown for PM6; one for PM1, 2 and 4).

3. Press EXIT to leave the screen.

5.2 To check dimmer performance

1. Press INST.
2. Press ↓ or ↑ to choose CHANNEL INFO menu. Press ENT.
3. The screen shows:

```
INFO                 CH:[1]
CURRENT              04,7A
```

4. Press ← or → to select other information as follows:

CURRENT: current in Amps measured at the output

VOLTAGE: voltage at the input of the dimmer

TEMPERATURE: i-tech dimmer module temperature

DMX: DMX level received

ACTUAL: the level the dimmer is responding to (may differ from DMX value due to MIN, MAX or MAN influence).

STATUS: error message(s) with details.

4. Press ↑ or ↓ to select another dimmer channel (shown in square brackets), or,

5. Press EXIT to leave the screen.

5.3 To check dimmer software versions

1. Press INFO, and wait for 3 seconds.
2. After displaying the nominal voltage, current and frequency settings, the screen shows:

```
P1:1.44              P2:1.44
P3:1.44              SYS:3.10
```

Where: P1, P2 and P3 are the dimmer processor software versions (P1 is only shown on 1, 2 and 4 channel PowerModules), and SYS is the front panel processor software.

Note: All dimmer processor software will have the same version number, but it will not be necessarily the same version as for the front panel. All software versions in the same installation should be identical. If they are not, contact your local distributor or IES directly.

3. After 3 seconds, the screen automatically resets to show the normal output details.

5.4 To manually control a dimmer level

It is possible to control any dimmer directly from the front panel using the cursor controls to set the desired level. This can be used for testing circuits, overriding control signals or setting an independent fixed level. The level is mixed with any other incoming signal on a highest level takes precedence basis.

1. Press MAN.
2. The screen shows:

```
L: ▭▭▮▮▭            242V
CH:T1234 5 6         08 A
```

3. Use ← or → to select a channel number (active channel number is underlined), or 'T' which controls all channels together.

4. Press ↑ or ↓ to adjust the level. The dimmer output is live while the level is being adjusted.

5. Press ENT to leave the menu and record the changes or EXIT to leave the previous settings unchanged.

5.5 To operate the chaser

The PowerBar has a sequence chaser to provide basic effects without a control desk. This is primarily used for exhibition and display lighting purposes. Twenty different effect sequences are pre-programmed into the PowerBar, and controls are provided to adjust master level, chase speed and to chose between fading and switching between steps.

1. Press CHAS.

2. The screen displays shows:

```
CH ST SP L              FADE
01 00 1,0 ▤             OFF
```

where:

CH is chase number

ST is step number

SP is speed (in seconds) from one step to another

L is a bargraph showing the master intensity

FADE selects either a fading chase (ON) and a switching chase (OFF)

3. Press ← or → to put the underline beneath the CH number, and use ↑ and ↓ to select the chase number required.

4. Press ENT to start the chase, and the screen shows e.g.:

```
CH ▤_▤_               AUTO
05 01 1,0 ▤           OFF
```

5. The step number will increment as the chase progresses, restarting at 1 at the end of each cycle.

6. With the chase number underlined, press ↑ or ↓ to switch to another chase pattern.

7. Use ← and → to underline (select) the level or FADE and press ↑ or ↓ to adjust the master level for each step (shown on the bargraph) and to choose between FADE ON (fades between steps) and FADE OFF (switches between steps).

6 Programming

6.1 Flow diagram

An overview of the flow chart showing the menu structure and options is shown as an appendix at the end of this manual.

6.2 General Programming Advice

6.2.1 Passwords

For clarity, the following sections which describe programming activities do not refer to the entry of passwords. Passwords are included to prevent unauthorised access to the DMX, CONFigure and INSTall menu trees. The passwords are 4-digit numbers with a factory default of 0000 (no password necessary). It is possible to have the same password for all, or separate passwords for each menu tree. If any of the protected menus is selected, the subsequent screen requests a password. This is achieved by pressing the relevant ← and → cursor buttons to select the digit, and the ↑ and ↓ cursor buttons to enter the number.

6.2.2 Navigation through the menus

The cursor buttons are used to move around the menu screens, and to activate a set-up option or parameter prior to adjustment. When a parameter or option is activated, it is shown in square brackets, e.g. [240] and it is this item which you are changing on the screen. When you press ENT to confirm the change, the screen will show:

```
DATA IS STORED
IN MEMORY
```

As this happens for each menu option, it is not included in each following instruction.

6.2.3 Channel characteristics

All dimmer-specific functional parameters may be set on a dimmer-per-dimmer basis. Thus each dimmer may have a different response time, curve, maximum level etc. if required. Alternatively, all dimmers in one PowerModule can be programmed together, depending on whether the dimmer set-up has been set to 'SINGLE or 'JOINED' (see paragraph 6.4.1). If the configuration is set to single,

a number is shown in each relevant channel reference [4], and if all dimmers are programmed together, a T is shown in square brackets [T]. Note that if T is activated, an underscore bar is added, making it appear as an 'I'.

6.3 Front Panel Controls

All of the performance and control characteristics, measurements and status reports, are available from the front panel controls and LCD screen. When power is applied and the MCB or RCBO is switched on, the power LED will illuminate. The DMX LED will illuminate if a valid DMX signal is present.
During the power-up reset process, the LCD display shows identification details and the software version before displaying the output screen:

```
L: ▤▭▤▤▭_              D:001?

CH:123456              A:032v
```
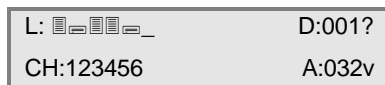
This display shows the channel levels (bargraphs at the top left), the DMX address of the first channel in the PowerBar (D:xxx) and the DimSTAT address of the unit (A:xxx). The number of bargraphs shown relates to the number of dimmers in the PowerModule – either 2, 4 or 6.

Note: A questionmark (?) adjacent to the DMX address shows the DMX signal is not valid, and the 'v' adjacent to the DimSTAT address number indicates communication is active.

6.4 General controls

PowerBar dimmers have the capacity to store performance characteristics individually for each dimmer or combined for all dimmers in the module. This feature is independent of the choice of DMX numbering scheme, thus the dimmers may have individual characteristics, but with consecutive DMX addresses.

6.4.1 To change the dimmer characteristic set-up scheme:
1. Press INST.
2. Press ↓ or ↑ to choose GENERAL SETTINGS menu.
   Press ENT.
3. Press ↓ or ↑ to choose CONFIG CHANNEL menu.
   Press ENT.
4. The screen shows:

```
GENERAL

CH_CONF.              [SINGLE]
```

5. Use ↑ or ↓ to select either SINGLE (for different individual channel parameters) or JOINED (if all dimmers have the same characteristics).
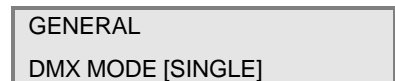
6. Press ENT (to record the changes) or EXIT (to leave the previous settings unchanged, and return to the home page).

6.5 DMX programming

Each dimmer in the PowerModule is assigned a DMX channel number. A feature is provided to set sequential number groups ('Start' addressing) instead of individual settings. When programming a PowerBar, IT IS IMPORTANT TO SET THE DMX ADDRESSING SCHEME before the individual characteristics are set, as a later change can reset previously recorded individual channel characteristic settings.

6.5.1 To set up DMX addressing scheme:
1. Press INST.
2. Press ↓ or ↑ to choose GENERAL SETTINGS menu.
   Press ENT.
3. Press ↓ or ↑ to choose DMX ADDRESS menu.
   Press ENT.
4. The screen shows:

```
GENERAL

DMX MODE [SINGLE]
```

5. Use ↑ or ↓ to select either SINGLE (for different individual DMX addresses) or JOINED (if the dimmers are numbered sequentially from the start address).
6. Press ENT (to record the changes) or EXIT (to leave the previous settings unchanged, and return to the home page).

6.5.2 To set-up DMX addresses:
1. First set the DMX scheme as described above (either individual or start address).
2. Press DMX, and the screen displays:

```
DMX: [001]                 002

CHAN.: 1                     2
```

3. If SINGLE has been selected, two channels are displayed at a time, with their relevant DMX address. Use ↑ and ↓ to select the address needed for the first dimmer channel and move to other channels by pressing ← and → and continue adjusting each DMX address by pressing ↑ and ↓ as before.
4. If JOINED has been selected, only one DMX number line is entered which is the number for dimmer 1. The remaining dimmers are automatically addressed in sequential order. Press ENT to store the

settings and to return to the previous menu.

Note: DMX address 000 deselects the channel from operation. Valid DMX numbers are between 001 - 512. If higher dimmer numbers are used by the control desk, the number has to be rationalised to a base of 512 for the dimmer address.

6.5.3 To set up a DMX backup condition

The PowerBar is equipped with a choice of responses to the failure of the DMX signal. The dimmers can be set to hold their last DMX level, fade to zero over 5 seconds, or fade to a preset memory setting. This choice is available per PowerBar.

1. Press INST.
2. Press ↓ or ↑ to choose GENERAL SETTINGS menu. Press ENT.
3. Press ↓ or ↑ to choose DMX FAIL menu. Press ENT.
4. The screen shows:

```
GENERAL

DMX FAIL          [HOLD]
```

5. Use ← or → to select one of the 3 options available:

RESET: sets all dimmers to zero after 5 seconds

HOLD: maintains the last valid DMX levels until DMX is restored

BACKUP: selects dimmer levels set-up through the PRESETS memory facility

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

Note: If BACKUP has been set, do not forget to pre-set the relevant DMX backup state.

6.5.4 To set-up DMX Backup preset:

1. Press INST.
2. Press ↓ or ↑ to choose DMX BACKUP menu. Press ENT.
3. The screen shows:

```
L: ▭▭▤▤▭          242V

CH:T1234<u>5</u>6          00 A
```

4. Use ← or → to select a channel number (active channel number is underlined) or T if all channels are to be set together.
5. Press ↑ or ↓ to adjust the backup level. The dimmer output is live while the backup levels are adjusted.
6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.5.5 To set-up a DMX Minimum reset

In order to reduce dynamic filament noise in some types of 120V Par lamps, it is sometimes necessary to use a low preheat level. DMX minimum reset is the automatic means to switch any preheat levels off when DMX is not present (i.e. when the control desk is switched off, but the dimmers remain on).

1. Press INST.
2. Press ↓ or ↑ to choose GENERAL SETTINGS menu. Press ENT.
3. Press ↓ or ↑ to choose MIN RESET menu. Press ENT.
4. The screen shows:

```
GENERAL

MIN RESET:          [OFF]
```

5. Use ↑ or ↓ to select either AUTO (preheat switches off when DMX is off) or OFF (preheat runs continuously).
6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.6 Serial address

The DimSTAT PC address which shown on the output screen as A:XXX is the unique number which is used by network to identify each dimmer unit for the purpose of reporting status information and for transferring data between the dimmer unit and PC. If a dimmer unit is removed from the network and replaced by another, DimSTAT will automatically prompt for an update of configuration information when the PC number is entered. DimSTAT identifies the new unit on the network, and prompts the operator to download the previous characteristics file from the PC to the new dimmer. The PC number is associated with a unique factory serial number which is permanently stored in the dimmer. An Autoreload function is also provided to reinstate the PC address after a factory reset.

6.6.1 To set-up a serial address:

1. Press INST.

2. Press ↓ or ↑ to choose DIMSTAT ADDRESS menu. Press ENT.

3. The screen shows:

ADDRESS:	[001]
AUTO-RELOAD	NO

4. Press ↑ or ↓ to set the address number between 001 and 255.

5. Press → to select auto-reload options of YES or NO.

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.7 Maximum & Minimum levels

It is possible to affect the output range of a dimmer by setting a minimum level and (or) a maximum level. A minimum level is used to provide a pre-heat to preheat lamp filaments, whereas the maximum level is used to limit power and extend lamp life. Minimum levels may be set between 0% to 29.9%, and maximum levels from 30% to 100%. Factory default levels are 0% for minimum and 100% for maximum. One common use for a reduced maximum level is to control 110V lamps but the 110V dimmer curve is recommended as it produces a smoother control over the whole range of intensity. However this should be checked in comparison with other lamps in the rig to ensure uniformity of response.

Note: In the case of high-inrush loads (e.g. Parcans) where flashing on from a cold state is required in a silent auditorium, or for 5kW lamps where the high inrush current could cause the short-circuit protection to report and error, it is recommended to set a 'minimum' preheat level to 5%. See also the section on DMX Minimum Reset.

6.7.1 To set-up max. and min levels:

1. Press CONF.

The screen shows the individual channel number (or T if the dimmer set-up scheme copies characteristics to all dimmers in the rack) and gives access to all configuration options.

CONFIG:	CH:[1]
MAX:	100%

Press ↑ or ↓ to select the required dimmer number.

Press → to select the maximum or minimum option, and to highlight the recorded value (in square brackets):

CONFIG:	CH:1
MIN:	[00,0%]

Setting options are :

MIN: minimum level from 00% to 29.9%.

MAX: maximum level from 30% to 100%.

5. Press ↑ or ↓ to select the level (shown in square brackets).

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.8 Response time

Each dimmer has two times associated with it which control the minimum time to fade in and out, and are called T-IN and T-OUT. These times are referred to as 'response times' and are used to protect the lamp filaments from thermal damage, and for reducing surges in the system. The default times are currently zero seconds (for the fastest response). Values recommended are 0.01s for a 1kW load, 0.1s for a 2kW load, and 0.5s for a 5kW load.

6.8.1 To set-up response times:

1. Press CONF.

2. The screen shows the individual channel number (or T if the dimmer set-up scheme copies characteristics to all dimmers in the rack) and gives access to all configuration options.

Press ↑ and ↓ to select the dimmer number.

CONFIG:	CH:[1]
MAX:	100%

Press → to select the response times T-IN or T-OUT, and to select the recorded value (in square brackets):

CONFIG:	CH:[1]
T_OUT:	[00,00]SEC

5. Adjust the time by pressing ↑ and ↓.

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

Note: Zero (0) seconds should not be used with TV-type high wattage lamps, where the minimum recommended is 0.05s. Faster response times should be used with care, and with lower wattage loads.

6.9 Dimmer curves

Dimmer curves (dimmer laws) are used to adjust the relationship between control level and light output. This enables the dimmer to be fine-tuned to accommodate the preferences of a live audience or a television camera. There are 8 factory standard dimmer laws, and a provision for further custom selectable curves in later software releases.
The factory default law (0) is Linear Law. The list of dimmer curves is as follows:

LINEAR	linear relationship (standard)
LINEAR5	LIN5 (as linear but with a small offset at 50%)
INV.LIN	inverted (when control = zero, dimmer = full etc.)
110V LIN	110V lamp load, linear law
S-LAW	S-Law
BBC	BBC specification (modified square law for TV applications)
FLU-50	Fluorescent (minimum 50%)
FLU-30	Fluorescent (minimum 30%)
FLASH	flash effect (light switches on and off as the control fades up and down)
NONDIM	Non-Dim operation (see note below)
9-14	for future use

Note: There are two options for setting Non-Dim (switch) operation – via the CURVE menu and the NON-DIM menu, both found in CONF. For Non-Dim operation, either or both options may be set, but for normal dimmer operation BOTH must be set to 'NO'.

6.9.1 To select a dimmer curve:

1. Press CONF.

2. The screen shows the individual channel number (or T if the dimmer set-up scheme copies characteristics to all dimmers in the rack) and gives access to all configuration options.

3. Press ↑ or ↓ to select the channel number.

```
CONFIG:                CH:[1]

CURVE: LINEAR
```

4. Press ➜ to select the CURVE option (shown in square brackets) and set the curve option by pressing ↑ and ↓.

5. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.10 Non-Dim operation

PowerBars may be set to switch on and off rather than dim, and in this way are used for many other functions such as switching power to working lights, non-dim and auxiliary circuits. There are two methods of selecting non-dim operation – as described here, and also as one of the 'Dimmer Curves' as described in the previous section.

Note: When in non-dim mode, the dimmer is operating in Phase-On mode only.

6.10.1 To select a dimmer to operate as a non-dim switch:

1. Press CONF.

2. The screen shows the individual channel number (or T if the dimmer set-up scheme copies characteristics to all dimmers in the rack) and gives access to all configuration options.

3. Press ↑ or ↓ to select the channel, and then press ➜ to select the NON-DIM option shown as follows:

```
CONFIG:                CH:1

I/O: [NO]
```

4. Press ↑ or ↓ to select I/O operation (either YES for Non-Dim or NO for normal dimming operation).

5. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

Note: A special feature is included to prevent damaging accidental 'flashing' to discharge loads. If T-IN is set to, say, 10 secs. and T-OUT to 99secs, then the on period is fixed for 10 seconds, and 99 seconds has to elapse before switching on is possible again.

6.11 Maximum current

Each PowerBar has a facility to measure the current and to restrict the operation of all dimmers (or in the case of PB6-2X, the dimmers on each phase) to ensure the maximum current is not exceeded. This operates as a 'maximum demand' protection system, and reduces the levels of all dimmers on the phase which is exceeding the preset current.

However, to eliminate the risk of an important light automatically dimming during a performance, it is possible to prioritise the channels which will reduce in intensity to ensure the maximum demand is not exceeded. This is achieved by setting the dimmer channel to "priority", and it will then ignore any instruction to reduce level if the maximum demand is exceeded.

The process is in three parts; setting a current limit, choosing any priority channels, and activating current limiting as described below:

6.11.1 To set-up maximum current levels:

1. Press INST.

2. Press ↓ or ↑ to choose LINE PARAMETERS menu. Press ENT.

3. The screen shows:

```
LINE V[240]

I:40 FREQ:50
```

4. Press ↑ or ↓ to set the typical voltage of the mains supply (shown in square brackets).

5. Press ➔ to select maximum current for the Bar (or per phase for the PB6-2x), and adjust the level using ↑ and ↓.

6. Press ➔ to select frequency and press ↑ or ↓ to switch between 50Hz or 60Hz.

7. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.11.2 To set-up priority channels:

1. Press CONF.

2. The screen shows the individual channel number (or T if the dimmer set-up scheme copies characteristics to all dimmers in the rack) and gives access to all configuration options.

3. Press ↑ or ↓ to set the channel number required, followed by ➔ repeatedly to select PRIORITY option shown as follows:

```
CONFIG:                    CH: T

PRIORITY: [NO.]
```

4. Press ↑ or ↓ to select this channel for priority operation (either YES for priority or NO for normal operation).

Note: If set to No, the dimmer will take part in a general lowing of intensity if the preset maximum current (maximum demand) for the phase in this dimmer rack is exceeded. If set to Yes, the dimmer will remain at its level, and others will reduce in level to maintain a maximum phase current.

5. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.11.3 To activate current limitation:

1. Press INST.

2. Press ↓ or ↑ to choose GENERAL SETTINGS menu. Press ENT.

3. Press ↓ or ↑ to choose CURRENT LIMIT menu. Press ENT.

4. The screen shows:

```
GENERAL

CUR.LIMIT:                 [ON]
```

5. Press ↑ or ↓ to set the current limiting function either ON or OFF (shown in square brackets).

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.12 Voltage regulation

Voltage regulation is a software feature which maintains the dimmed level of channels in the event of the mains supply fluctuating (e.g. when power is supplied from a generator source or a high-impedance main). The dimmer's incoming voltage is measured, and if it diverts from the anticipated incoming voltage, the dimmer will adjust the output accordingly to maintain a constant voltage at the output. The dimmer will maintain output to about 1V for every 10V input voltage swing. This feature does not maintain the voltage of full-on dimmer channels, as the regulation circuit can only work with sufficient voltage headroom. Programming involves two stages, firstly setting the nominal voltage, and secondly activating the voltage regulation software.

6.12.1 To set nominal voltage

1. Press INST.

2. Press ↓ or ↑ to choose LINE PARAMETERS menu. Press ENT.

3. The screen shows:

```
LINE    V[230]

I:44    FREQ:50
```

4. Press ↑ or ↓ to set the voltage expected (shown in square brackets).

5. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.12.2 To activate voltage regulation

1. Press INST.

2. Press ↓ or ↑ to choose GENERAL SETTINGS menu. Press ENT.

3. Press ↓ or ↑ to choose VOL. REGULATION menu. Press ENT.

4. The screen shows:

```
GENERAL
```

VOL.REG.	[ON]

5. Press ↑ or ↓ to set the voltage regulation function either ON or OFF (shown in square brackets).

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.13 Phase-On and Phase-Off

The i-tech modules can be programmed to control power by switching OFF every half cycle (Phase-off or reverse phase), or to switch ON each half cycle (phase-on or forward phase) in the conventional way of triacs and thyristors. With some highly inductive loads such as transformers, or capacitive loads such as fluorescent tubes, improved level of control can be achieved by using Forward mode (phase ON). In situations where harmonic currents have to be minimised to the lowest levels possible, half of the dimmers may be set to reverse phase (phase OFF), and the remainder to forward phase (phase ON) thus cancelling out a high proportion of the already reduced harmonics. Obviously the feature cannot completely eliminate harmonic currents as dimmers are used selectively, and therefore cannot be guaranteed to be used in opposing pairs.

*Note: Highly inductive loads **must** be controlled in Forward, phase-ON mode to avoid any risk of damage to the itec module.*

6.13.1 To set-up forward and reverse phase operation:

1. Press CONF.

2. The screen shows the individual channel number (or T if the dimmer set-up scheme copies characteristics to all dimmers in the rack) and gives access to all configuration options.

3. Press ↑ or ↓ to select the required channel number, and then press ➜ to set the PHASE option shown as follows:

CONFIG:	CH: 3
PHASE:	[OFF]

4. Press ↑ or ↓ to select this channel for PHASE OFF (normal IGBT operation) or PHASE ON.

5. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.14 Start Mode

PowerBars are equipped with a software feature to alter the criteria for dimming cold filaments. The response of a dimmer depends on the resistance of the filament, which varies according to temperature. A cold filament has a slower response than a warm filament. Although the i-tech modules restrict maximum current to 10 times the nominal current, if the complete rig is subject to a sudden loss and resumption of power (a 'brown-out') it is possible for the combined cold switch-on load to be higher than the diversified power supply can withstand, resulting in nuisance tripping of circuit breakers. For this reason, the dimmers are installed with a range of start modes to give the users flexibility in the set-up characteristics of the dimmer.

An additional feature is Blink mode which flashes the dimmer channel with a controllable mark-space and flash rate for warning signs in the studio or backstage. The options are:

BASIC: Normal mode

SOFT START: If the circuit has not been used for 5 minutes, the initial response time is automatically set to 500mS

BURST: If the circuit has not been used for 5 minutes, the dimmer burst-fires 20 cycles at full power to heat the filament rapidly and to improve response.

PROP: Proportional burst start mode. The number of full power cycles is in relation to the speed of rise of DMX signal between 0% and 9%.

BLINK: Flashes the output to full. T-IN sets the fade in time, T-OUT sets the fade out time, and the DMX level sets the period of flash.

6.14.1 To set start mode

1. Press CONF.

2. The screen shows the individual channel number (or T if the dimmer set-up scheme copies characteristics to all dimmers in the rack) and gives access to all configuration options.

3. Press ↑ or ↓ to select the relevant channel number and then repeatedly press ➜ to select the START option shown as follows:

CONFIG:	CH:2
MODE:	[BASIC]

4. Press ↑ or ↓ to select the start mode required.

Note: If BLINK has been set, be sure to adjust the T-IN and T-OUT times to create the required flash characteristic, and adjust the DMX value when used for the period of flash.

5. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.15 Passwords

Passwords are used at 3 levels of the PowerBar dimmer set-up procedure: DMX, CONF. and INST. One password or 3 separate passwords may be used to give a range of access options. Passwords are in the form of 4 digit codes and may be set and used from the front panel of the dimmer and DimSTAT, but passwords may only be read using DimSTAT. Passwords set at 0000 give unlimited access.

Note: If the password is set to 0000 (factory default) the menus are open, and no prompts to enter a password are seen on the display. The service access password is 3415.

6.15.1 To set-up passwords for the first time, and to alter a previous password:

Note: Programming passwords for DMX programming, Channel configuration and Installation follows the same procedure which is described here for DMX only.

1. Press INST.
2. Press ↓ or ↑ to choose PASSWORD DMX menu. Press ENT.
3. The screen shows:

```
NEW PASSWORD

                    [*]:*:*:*
```

4. Press ← or → to select a digit to enter (shown in square brackets).
5. Press ↓ or ↑ to adjust the digit.

Note: Make a copy of passwords set in the back of this handbook, as the passwords can be interrogated only via a DimSTAT link to a remote PC. Resetting the password to 0000 disables the previous setting.

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.16 Sleep mode

The SLEEP function has been included to switch off the backlit LCD screen during a performance when the control panels are in view of an audience or camera. When enabled, the sleep function switches off the backlight a short time after the last touch of a panel button, and switches back on when a front panel button is pressed.

6.16.1 To set the dimmer rack to 'Sleep' mode

1. Press INST.
2. Press ↓ or ↑ to choose GENERAL SETTINGS menu. Press ENT.

Press ↓ or ↑ to choose SLEEP MODE menu. Press ENT.

4. The screen shows:

```
GENERAL

SLEEP MODE          [ON]
```

5. Use ↑ or ↓ to select either ON (dimmer functions reduce when DMX is off) or OFF (dimmers run continuously).
6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

6.17 Fault reporting

If a discrepancy in the normal operating parameters is registered, the PowerBar will report the potential fault and will take action to minimise the effect of the fault. The CHK LED illuminates if a fault is recorded, and any circuit errors are reported on the screen above the channel number affected as shown below for channel 5 which is displaying a short-circuit condition:

```
L: ▭▭▤s▭            D:025

CH:123456           A:001v
```

code 'l' =   no load (control present but no output)

code 's' =   short circuit

code 't ' = over temperature

code 'o' =   overload (e.g. 4kW plugged into a 2kW dimmer)

code 'c' =   no control (e.g. output with no control signal)

code 'v' =   voltage out of range (either over or under voltage)

code 'd' =   fault has persisted beyond a default auto-reset time, and the dimmer has been disabled awaiting manual intervention and reset.

The channel display indicators give the last recorded fault condition. If the fault is a self-resetting fault, or if the dimmer is automatically disabled, the reason for the problem may not be obvious from the channel display. However, a log of the errors is shown in detail through DimSTAT, and a summary of the history is shown using the dimmer's LCD screen as follows:

6.17.1 To check fault reports and to reset the log.
1. Press CHK.

Note: This screen never requires a password.

2. The screen shows:

```
ERR.STATUS:          CH:01

SHORT                   03
```

where: 03 is the short circuit error code, and 01 is the affected dimmer circuit within the module.

3. Press ↓ or ↑ to view any other reports in the error log

4. Press ENT to leave the menu and CLEAR the log or EXIT (to leave the log unchanged).

6.18 Return to factory settings

The PowerBar is supplied with a set of factory default settings and recommended software set-up parameters. It is advisable to reset the dimmer software to the original factory settings in the case of a significant software update.

6.18.1 To reset the dimmer rack to factory default settings
1. Press INST.

2. Press ↓ or ↑ to choose FACTORY RESET menu. Press ENT.

3. The screen shows:

```
ARE YOU SURE ! !

CLEAR MEM.            [NO]
```

4. Press ↑ or ↓ to select YES (shown in square brackets).

5. Press ENT to leave the menu and reset the PowerBar's memory or EXIT (to leave the previous settings unchanged).

Factory defaults are:

AUTORELOAD: NO
CHANNEL CONFIG.: JOINED
CURRENT: 44A
CURRENT LIMITATION: OFF
CURVE: LINEAR
DMX ADDRESS: 001

DMX BACKUP: all 00
DMX FAIL: RESET
DMX MODE: JOINED
DMX MINIMUM RESET: OFF
FREQUENCY: 50Hz
MAXIMUM: 100%
MINIMUM: 0.00%
MODE: BASIC
NON-DIM (I/O): NO
PASSWORDS: all 0000
PC ADDRESS: 000
PHASE: OFF
PRIORITY: NO
SLEEP: OFF
T-IN: 0.00 secs.
T-OUT: 0.00 secs.
VOLTAGE: 235V
VOLTAGE REGULATION: OFF

7. DimSTAT

DimSTAT provides a system-wide network, and operates on a host polling protocol where the PC searches for connected dimmers at initiation, and then regularly polls dimmers for data to display. If a fault occurs, the PC's display instantly shows the detail, and if the fault is cleared the system resets accordingly. Information displayed includes: DMX start address per unit, DMX OK, line voltage, current per channel, dimmer curve, response time, max. setting, type of fault reported (temperature, overload etc.), date and time of fault. It is possible to set the dimmer curve, start address and pre-heat from DimSTAT software on the PC. The operation and performance of the PowerBar dimmer is monitored constantly and comprehensively by the on-board data processors, and this information is available on the LCD screen of the dimmer, and through DimSTAT. The parameters measured and reported are:

a) DMX OK

b) DMX channel numbers

c) DMX levels

d) line voltage

e) current per dimmer

f) current per phase per rack

g) frequency

h) dimmer curve

i) temperature per module

j) temperature per rack

For further information, please refer to the DimSTAT software manual.

8. Fault finding

8.1 Reported faults

8.1.1 No load (control present but no output)
This can be reported if either a load fails (lamp blows without shorting the output first), or the load is disconnected in error, or a load is not connected.

8.1.2 Short circuit
This can happen if a lamp filament blows, or if a faulty cable or luminaire is connected to the circuit. A temporary short circuit such as a lamp failure will produce a SHORT report in the log, but the dimmer will usually reset to normal operation when the fault has cleared. If the fault continues, the report will change to DISABLE. Disconnect the dimmer and check the circuit wiring and connected loads for the short.

8.1.3 Over temperature
If one of the IGBT modules exceeds an operating temperature of 80°C, the dimmer will switch off and report an overtemperature condition. This can be caused if the ventilation is obstructed (e.g. the dimmer is resting on the floor and is being used continuously at full load).

> *Note: As the temperature rises above the normal operating ceiling of 60°C, the dimmer automatically takes progressive temperature reducing actions such as dynamically adjusting the filtering, and switching into phase-on mode.*

8.1.4 Overload
The dimmer will respond quickly to any error which demands a higher current than expected, for example 4kW plugged into a 2.5kW dimmer. The dimmer will automatically switch off and after 3 seconds will attempt to fade up the circuit again. If this process fails 3 times, the dimmer will report an overload and will disable until the fault is cleared and the dimmer reset.

8.1.5 Control
The control fault indicates a problem controlling the load within the dimmer. This can result in the dimmer channel giving a full output under any control condition, and can only be repaired by an exchange of i-tec IGBT module. However, if this fault occurs the dimmer circuit should be carefully assessed to find a cause before another module suffers the same problem. Typical system problems are high voltage spikes caused by an unbalanced generator supply, or a highly inductive load which has not been controlled in PHASE-ON mode.

8.1.6 Voltage out of range
If the supply voltage varies above or below the nominal voltage anticipated (and set as the benchmark) the dimmer will close down and report a voltage error. In the case of temporary supply fluctuations, the fault will auto-reset, but if the dimmer shuts down, the first point to check is the voltage calibration setting of the dimmer to make sure it is set to the local supply voltage.

8.1.7 Disable
If a fault persists beyond a default auto-reset time, the dimmer will close down awaiting manual intervention and reset. Check the fault log to see the type of fault which caused the dimmer to disable.

8.2 First line maintenance

This check list provides initial assistance in the case of a problem which has not been identified and reported by the dimmer's own software.

8.2.1 LCD display blank
Check all power supply connections. Check module's RCBO or MCB is on.

8.2.2 LCD display corrupted
Switch off and on again. If the fault persists, open the module and check all connections, and that plug-in ICs are secure in their sockets.

8.2.3 No output from one channel
Check the control signal is active. Check the DMX address is correct. Check there is no 'l' showing on the output screen. Remove the itec module and check the internal 15A fuse.

8.2.4 RCBO trips continuously
Unplug all load plugs. If the fault persists, refer to service technician. If the RCBO holds in, replace one plug at a time until the RCBO trips again. Check the circuit (cables, plugs and sockets, distribution, lights) for a loose terminals, a phase to neutral short, a phase to earth short or a neutral to earth short and correct where necessary.

8.2.5 Dimmer output is full on all the time
Disconnect the DMX cable to isolate control. If the dimmer is still on, check a) the MANual level has not been set to 100%; b) the dimmer curve has not been set to 'Inverted'; c) the MIN level is at zero. If the dimmer is still on, and there is no 'Control' fault identified, refer to a service technician.

If the dimmer switches off when the DMX cable is removed, check that both NON-DIM mode selections (dimmer curve and Channel Configuration I/O) are set to OFF. If either or both these functions are set ON, the dimmer will be operating in Non-Dim mode.

8.2.6 Lamp filaments are noisy

Check the dimmer is set to 'phase off' mode. Replace the lamp with a new lamp, and in the case of 110V Parlamps, try the circuit with a different manufacturer's lamp, as some lamps are noisy even on switched mains supplies.

8.2.7 Dimmers work, but DimSTAT doesn't recognise all or some dimmers

Check the DMX network to ensure 2-pair cable is used and correctly connected throughout. If a DMX booster/isolator unit is used in the network, check that it supports bi-directional data on pins 4 and 5.

8.2.8 Voltage regulation is not operating properly

The PowerBar uses a relative measurement of mains voltage in the general operation of the dimmer circuit, in the status reporting system, fault detection and reporting, and output voltage compensation. For accurate measurement and operation, the incoming mains supply voltage at the dimmer is calibrated at the factory. If this calibration is wrong, the voltage-related parameters will be affected. The solution is to recalibrate the PowerBar.

Note: IMPORTANT. This set-up procedure may only be carried out by a qualified electrical engineer as it involves an accurate measurement of the mains supply.

8.2.9 To calibrate line voltage

This requires a true RMS digital voltmeter, and a safe means of connecting the voltmeter to the dimmer's supply. If the mains supply is known to have a high impedance, it is advisable to take the measurement under normal operating loads so that voltage drop in the supply can be accommodated in the measurement.

1. Measure the voltage of the PowerBar power supply.

2. Press INST.

3. Press ↓ or ↑ to choose CALL.VOLTAGE menu. Press ENT.

4. The screen shows:

```
SERV CODE           ????
ENTER ↵           ←↑↓→
```

4. Press ↑ to set the first number to '3' and press ➔ to enter the other digits '4', '1', '5'. The screen now shows:

```
L-1 L-2 L-3
[242] --- ---
```

Note: The screen shows L-1, L-2 and L-3 for the three-phase PB6-2X PowerBar.

5. Press ↓ and ↑ to adjust the voltage to match the voltage measured at the supply.

Continue with the other two phases in the case of the PM6.

6. Press ENT to leave the menu and record the changes or EXIT (to leave the previous settings unchanged).

9. Specifications

product reference:	PB4-X	PB4-2X	PB6-2X	
Order code	9906	2003	9907	
Channels	4	4	6	

electrical specification:				
Load per channel	1250W	2.5kW	2,5kW	
Supply Voltage	----- 180V - 260V AC -----			
Line voltage regulation (< full)	+/- 1V for 10V variation in supply within the input range 200V-260V			
Supply frequency	----- 50Hz - 60Hz -----			
Supply phase	single	single	single	
Supply Amps	22A	44A	3 x 22A	
Current limitation	Preset max. current per PowerModule with 'priority' channel designation			
Minimum load	----- none -----			
Load phase angle	----- 0.5 to unity -----			
Efficiency	------ 98% ------			

circuit protection:				
Electronic short-circuit protection	----- yes -----			
Fuse type (additional)	15A	15A	15A	
RCD 30mA	no	no	63A/2-pole	
Power device	----- IGBT -----			
Phase control	----- reverse & forward -----			
Non-dim function	----- per channel -----			
Max. Ambient temperature	----- 30°C -----			

weights & dimensions:				
Module size (cm)	-----1,5mx140mm x 70mm---			
Weight	10,5kg	11kg	12,3kg	

connectors:				
Supply Input connector	3x4mm^2 cable	3x10mm^2 cable	5x10mm^2 cable	
Supply Output connector	none	none	none	
Output connectors (CEEform)	4x16A	4x16A	6x16A	
Control connectors(in and out)	----- XLR-5 -----			
DMX data	----- pins 2+3 -----			
DimSTAT data	----- pins 4+5 -----			

product reference:	PB4-X	PB4-2X	PB6-2X
Control signal	----- DMX-512 4-wire (DMX and DimSTAT bi-directional data) -----		
Max. level preset	----- 30% - 99.9% (full) -----		
Min. level preset	----- 0% - 29.9% -----		
Response time preset	----- 0.00 secs - 9.9 secs for up and down -----		
Local control displays	LCD screen & cursor controls to access all functions and status		
Password protection	3 passwords: DMX set-up, dimmer configuration, installation features		
Status reporting	----- yes, using a PC running DimSTAT™ software -----		
Serial communication	----- yes, using a PC running DimSTAT™ software -----		
Dimmer curves	----- 16 -----		
DMX backup	----- programmable for hold, fade to zero, or backup memory -----		
Chase patterns (factory set)	----- 20 -----		
Blink mode	----- yes, with variable mark-space ratio and DMX-controlled flash rate -----		

standards:	
Low voltage directive	----- complies with 76/23/EEC -----
EMC directive	----- complies with 89/336/EEC -----

IES   I.E.S. B.V.

DECLARATION OF CONFORMITY

According to ISO / IEC Guide 22

Manufacturer's name: I.E.S. B.V.
Manufacturer's address: Wageningselaan 52-54
3903 LA Veenendaal
Netherlands

Declares that the product:
Product name: **PowerBar**
Model number: **PowerBar   no.9906 / 2003 / 9907**

Conforms to the following product Specifications:

Emission	EN 50081-1 / EN 50081-2
	EN 55011
	EN 55014

Immunity	EN 50082-1 / EN 50082-2	
	EN 55024-2	6 kV Contact discharge
		8 kV Air discharge
	EN 55024-3	3 V / m
	EN 55024-4	1 kV Signal lines
		2 kV Power lines

Supplementary information: The product complies with the EMC Directive 89/336/EEC.

Veenendaal
December 2000

J.H.D. de Jonge
Technical Manager

11. Index

Appendix: Flow Chart

```
          I.E.S.
      DIGITAL DIMMER

   VERSION   X.20
   IES (C)  90-1999

       CLIENT:
   DIM IN SILENCE

   L:▉▉▉      D:001?
   CH:123456  A:032v
```

```
DMX    PASSWORD   ????   ENT   DMX:  [001] 002   ENT   DATA IS STORED
       ENTER   ↵ ←↑↓→            CHAN:   1   2         IN MEMORY
                                                 EXIT

CONF   PASSWORD   ????   ENT   CONFIG:   CH:[1]   ENT   DATA IS STORED
       ENTER   ↵ ←↑↓→            T_OUT  00.00 SEC       IN MEMORY
                                                 EXIT

INFO   ACTUAL    F:50Hz   3 sec   P1: 1.44   P2: 1.44   3 sec
       U:230 V   I:04.4A          P3: 1.44   SYS:3.10

PWR    U:221 222 223   V   EXIT
       I:  00  00  00  A

MAN    L:▉▉▉      223V   ENT   DATA IS STORED
       CH:T123456   00 A        IN MEMORY
                          EXIT

CHK    ERR STATUS:   CH   ENT   ALL ERRORS
       01 SHORT      01         ARE CLEARED
                          EXIT

CHAS   L:S▉▉▉     CH:20   EXIT
       CH:E123456   SP:05

INST   PASSWORD   ????   ENT   LINE PARAMETERS   ENT   LINE  V[230]   ENT   DATA IS STORED
       ENTER   ↵ ←↑↓→           ENTER  ↵    →          I:40  FREQ:50         IN MEMORY
                         EXIT                                          EXIT

                         EXIT   DIMSTAT ADDRESS   ENT   ADDRESS:  [001]   ENT   DATA IS STORED
                                ENTER  ↵   ↑↓           AUTO-RELOAD NO.          IN MEMORY
                                                                          EXIT

                         EXIT   GENERAL SETTINGS   ENT   DMX FAIL   ENT   GENERAL           ENT   DATA IS STORED
                                ENTER  ↵   ↑↓            ENTER  ↵   ↓       DMX FAIL [HOLD]        IN MEMORY
                                                  EXIT                                      EXIT

                                                  EXIT   DMX ADDRESS   ENT   GENERAL            ENT   DATA IS STORED
                                                         ENTER  ↵   ↑↓       DMX MODE[SINGLE]         IN MEMORY
                                                                                             EXIT

                                                  EXIT   CONFIG CHANNEL   ENT   GENERAL           ENT   DATA IS STORED
                                                         ENTER  ↵   ↑↓          CH-CONF:[SINGLE]        IN MEMORY
                                                                                                 EXIT

                                                  EXIT   SLEEP MODE   ENT   GENERAL            ENT   DATA IS STORED
                                                         ENTER  ↵   ↑↓       SLEEP MODE [ON.]        IN MEMORY
                                                                                             EXIT

                                                  EXIT   VOL. REGULATION   ENT   GENERAL          ENT   DATA IS STORED
                                                         ENTER  ↵   ↑↓           VOL. REG.  [ON.]       IN MEMORY
                                                                                                 EXIT

                                                  EXIT   CURRENT LIMIT   ENT   GENERAL            ENT   DATA IS STORED
                                                         ENTER  ↵   ↑↓          CUR.LIMIT:[ON.]         IN MEMORY
                                                                                                 EXIT

                                                  EXIT   MIN    RESET   ENT   GENERAL            ENT   DATA IS STORED
                                                         ENTER  ↵   ↑↓         MIN RESET:[OFF.]        IN MEMORY
                                                                                              EXIT

                         EXIT   CALL. VOLTAGE   ENT   SERV CODE  ????   ENT   L-1  L-2  L-3   ENT   DATA IS STORED
                                ENTER  ↵   ↑↓         ENTER  ↵            221 [222] 223          IN MEMORY
                                                                                        EXIT

                         EXIT   FACTORY RESET   ENT   ARE YOU SURE ??   ENT   FACTORY SETTING
                                ENTER  ↵             CLEAR MEM. [NO.]         TO MEMORY
                                                                       EXIT

                         EXIT   CHANNEL INFO   ENT   INFO    CH:[1]   EXIT
                                ENTER  ↵   ↑↓        CURRENT 00.0  A

                         EXIT   DMX BACKUP   ENT   L:▉▉▉     223V   ENT   DATA IS STORED
                                ENTER  ↵   ↑↓       CH:T12345   00 A       IN MEMORY

                         EXIT   PASSWORD DMX   ENT   NEW  PASSWORD   ENT   DATA IS STORED
                                ENTER  ↵   ↑↓        [x]x:x::x             IN MEMORY
                                                                    EXIT

                         EXIT   PASSWORD CONFIG   ENT   NEW  PASSWORD   ENT   DATA IS STORED
                                ENTER  ↵   ↑↓           [x]x:x::x             IN MEMORY
                                                                       EXIT

                         EXIT   PASSWORD INSTALL   ENT   NEW  PASSWORD   ENT   DATA IS STORED
                                ENTER  ↵   ↑↓            [x]x:x::x             IN MEMORY
                                                                        EXIT

                         EXIT   TYPE SELECTION   ENT   SERV CODE  ????   ENT   TYPE SELECTION   ENT   DATA IS STORED
                                ENTER  ↵   →           ENTER  ↵             [6 CHANNEL-T _]         IN MEMORY
                                                                                            EXIT
```