

Digital Enclosure Control – DEC3.2™ Manual

Use this supplement if your DEC controller looks like THIS:



August 29th, 2011

Tempest Lighting, Inc.
13110 Saticoy Street, Unit C
North Hollywood, CA 91605
USA

Introduction

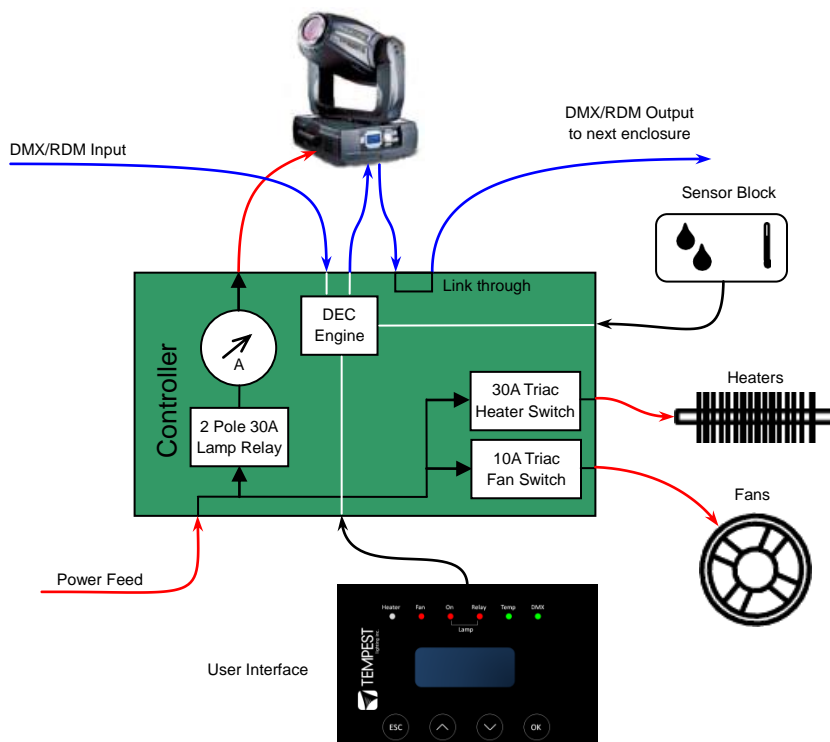
Tempest Lighting and Projector Enclosures have been in daily use around the world for almost a decade. Tempest enclosures protect expensive and delicate equipment in all climates, maintaining a comfortable operating temperature, and preventing condensation – the real outdoor enemy.

DEC3.2™ – that’s *Digital Enclosure Control, third Generation, revision 2* – is the brain of your Tempest enclosure. It will maintain the internal environment in a comfortable temperature and humidity range, and prevent condensation – the real equipment killer. DEC3.2 monitors internal temperature, humidity and lamp current at all times, and uses this information to control its lamp relay, fan(s) and heater(s). It can report back over the DMX cable, using the RDM protocol (Remote Device Management) if desired.

Unless otherwise specified, this version of the user guide refers to DEC3.2 units fitted with software version 0.1.xxx or later.

So, what does DEC3.2 actually DO?

The DEC3.2 Engine is the brains of the operation – here’s a layout:



This schematic shows the relationship between DEC3.2’s functional elements.

The power supply is universal 100-240V, but fans and heaters are either 120V or 230VAC, and must be so specified.

High-quality, high power Electro-mechanical relays provide two pole power isolation for the enclosed the fixture/projector in the event of an over-temperature condition.

Fans and heaters are switched using generously overrated Triac devices for maximum reliability.

4 DMX connections are provided to facilitate field termination of DMX inputs and outputs via the enclosed fixture and the controller.

DEC3.2's mission is to maintain temperature and humidity inside the enclosure, within determined bounds, and to prevent condensation – particularly overnight dew formation – inside the equipment housed. Condensation is fatal to electronic equipment, particularly in polluted areas or saline environments, where it brings not only rust and short-circuits, but also a steady buildup of mineral and/or salt deposits. Incidentally, condensation is very hard to control with air-conditioning type systems, which is why we don't use them.

Broadly speaking, DEC3.2's function depends on whether the fixture/projector lamp is on or off:

Lamp ON

When the projector/fixture is running, the heat from the lamp takes care of humidity, and DEC3.2 runs the enclosure's fan(s) to change its air every couple of seconds – ensuring high-velocity forced-air cooling while the lamp is on.

Lamp OFF

When the lamp is off, DEC3.2 senses temperature and humidity and controls its fan(s) and heater(s) accordingly. When conditions are within normal bounds (between top and bottom temperature settings and below the humidity threshold (see below), DEC3.2 pulses the heater at a low level to dry the air and eliminate condensation, and runs the fans to change the enclosure air every 30 seconds or so. We call this 'pulse mode', and it is the key to preventing damaging condensation inside your equipment.

If the temperature rises above the top set limit (see below), DEC3.2 runs the fans to cool it down. In cold conditions, DEC3.2 will run the heater as required to maintain the bottom set temperature.

Thus, DEC3.2 maintains a comfortable operating temperature inside the enclosure, and prevents damage from condensation. Users all over the world have found that Tempest enclosures provide an optimal environment for expensive and delicate equipment, in every climate type.

And while doing all of this, DEC3.2 can tell you what's happening over your RDM network – a real boon in larger installations. You may also use RDM to configure your Tempest installation remotely, using an appropriate RDM front end.

Default Operation

In most lighting and in almost all projector enclosure applications, DEC3.2 will work just fine with its factory default settings. *You do not need to do anything* other than connect power and switch on. We call this *Basic mode*, and it will apply to most installations. If your needs are more complex, read on.

If not, you can skip to the Power Connections section below.

Operating Modes

DEC3.2 may be run in one of three basic operating configurations with a fourth configuration for test and service use by trained personnel only. In the RDM context, these configurations are the device's DMX PERSONALITY.

The DEC3.2 mode or personality may be configured from the Front Panel or by using an RDM control. In all configurations, the fixture inside the Tempest enclosure may also be an RDM enabled device.

Basic Mode

This is the way your DEC3.2 controller will normally ship from the factory. It will be set up for standalone operation, with settings that will be appropriate for most installations.

In most cases, Basic Mode will work fine for you. You only need to change it if you will be using DMX or RDM (and if these terms are not familiar to you, you probably won't) or if you have to deal with extreme climate conditions.

You may set temperature and other parameters while using Basic Mode.

Monitor Mode

The enclosure operates independently, and automatically, requiring no user intervention. Users may set parameters such as temperature and humidity thresholds, and monitor sensor information and DEC status at the DEC3.2 using the display, or remotely, using RDM over a DMX512 network. In this mode, the DEC3.2 does not need to "see" any DMX to operate.

Control Mode

This mode has all of the Monitor Mode features plus control of the Lamp Relay using a single DMX slot at the address configured as the DEC3.2 DMX start address.

A DMX slot value > 75% will cause the fixture to be powered and less than 25% will disconnect the power from the fixture. On DMX fail, the Lamp Relay will default to power the fixture, unless it detects a thermal condition that would cause it to isolate power from the fixture/projector.

DMX control of the Lamp Relay has the useful attribute of enabling the user to remotely force a hard reset of the fixture by controlling power to it. This mode is recommended for show-control applications, where it is desirable to have power control of the internal fixture and accidental loss of the DMX data is very unlikely to occur.

To force a hard fixture reset, take the enclosure's DMX channel to zero (or any level below 25%), allow time for the fixture's power supplies to fully discharge, then restore the enclosure's DMX channel to full (or a level above 75%).

Service Mode

This mode is intended for test and service use only, giving the user direct control of the Lamp Relay, fan and heater controls over three DMX slots. Users may NOT override any of the controls in an unsafe direction – for example, if the DEC3.2 has determined the enclosure is over-temperature and has switched off the power to the fixture, the Lamp Relay may not be controlled by DMX. In this sense, DMX 'piles on' to DEC3.2 operation, within defined safety limits. However, until such time as the temperature reaches the TOP limit, the heater may be enabled and the fan disabled, which is why the mode should only be used for Test and Service use by a trained technician.

DEC3.2 Control Parameters

DEC3.2 will run out of the box with its default parameter settings, which equate to the (fixed) settings of its predecessor DECs 1 and 2.

Temperature:

Top Set *Range 35-45°C, Default = 40°C*

Most manufacturers recommend a max temperature for their equipment of 40°C, though this does vary. When DEC3.2 senses a temperature higher than Top Set, it indicates an overtemp condition as a warning.

NOTE: in moving light enclosures the thermal sensor is necessarily placed in the exhaust air path, which will be higher (sometimes a lot higher) than

the actual fixture ambient. This needs to be kept in mind when adjusting temperature settings.

Cutoff Temp *Range 0-15°C, Default = 15°C*

This is a setting *above* the Top Set temperature that determines the temperature at which the lamp relay is opened cutting off power from the fixture/projector. User may reduce it as desired, but should establish before doing so the actual operating temperatures experienced in hot weather before doing so, to avoid nuisance tripping.

Bottom Set *Range 0-10°C, Default = 10°C*

The temperature maintained by the heater in cold conditions. Most equipment manufacturers recommend a minimum operating temperature of 0°C, and users may set it lower than the default if desired.

Humidity *Range 50-90%, Default 80%*

The threshold at which incoming air is more aggressively heated to remove moisture.

DMX Address *Range 001-510, Default 001*

Sets the DMX address for the lamp relay control. In the DMX/RDM service mode, the subsequent two DMX slots control fan and heater respectively.

Fan Overrun *Range 1-15 minutes, Default 5 minutes*

This is the time that the enclosure fan(s) will run after the fixture/projector lamp is turned off. As a general rule, the more powerful the lamp, the longer the overrun should be, to prevent overheating while the lamp cools down.

Temp C/F *Default Celsius*

DEC3.2 displays temperatures in Celsius or Fahrenheit.

Lamp Hours *Default 0000*

DEC3.2 counts the hours your projector/fixture lamp is on, and can report it both on the user interface display and over RDM. Remember to reset to 0 when changing lamps. This is provided to allow lamp hours monitoring on devices such as Video Projectors that have no native RDM or DMX support.

Setup and Connections

DMX Connections

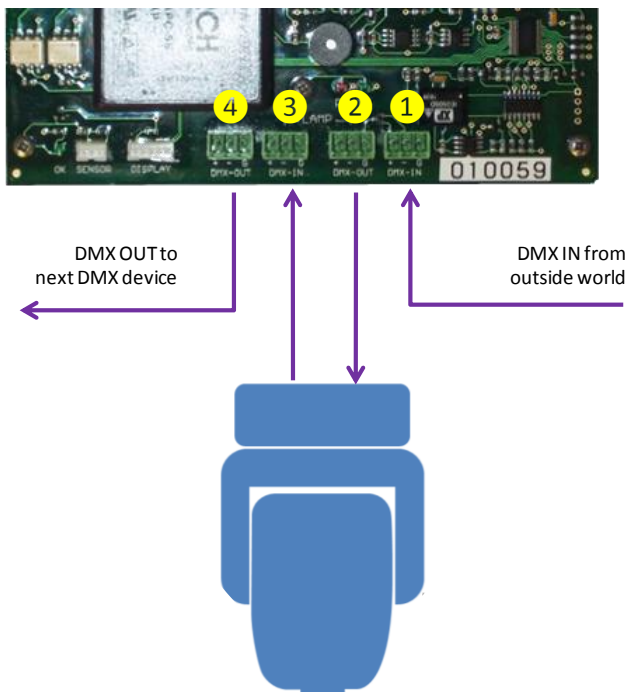
DMX refers to USITT DMX512, a commonly used control protocol in the entertainment industry, running over RS485. Consult USITT DMX installation guidelines when laying out a system, or employ a qualified DMX system integrator.

Note that DMX is optional - in many applications it is not required, and need not be connected. A DMX network will be required if:

- a) The fixture inside the enclosure requires a DMX control signal
- b) You wish to monitor the enclosure using RDM
- c) You wish to control the fixture power over DMX

DMX Terminations

Pinout: (1) Ground, (2) Data -, (3) Data +.



The picture shows the 4 DMX connections on the controller. The incoming DMX feed should always be wired to DMX-IN (1). If the enclosed fixture shares the DMX signal, the fixtures DMX IN should be wired from connection (2) and its DMX OUT wired to connection (3). Connection (4) will then be the DMX OUT for the enclosure. *If the enclosed fixture does not use the DMX connection, then DMX connection (2) on the controller becomes the DMX OUT for the enclosure.*

DMX Line Terminations

DMX cable runs must be terminated at the far end of the cable run with a termination resistor as detailed in the DMX512 standard.

The individual fixtures installed inside the Tempest enclosures must NOT be terminated.

It is recommended that any line termination is done using the 3-pin terminal connector fitted to the DEC3.2 control circuit board.

RDM Connections

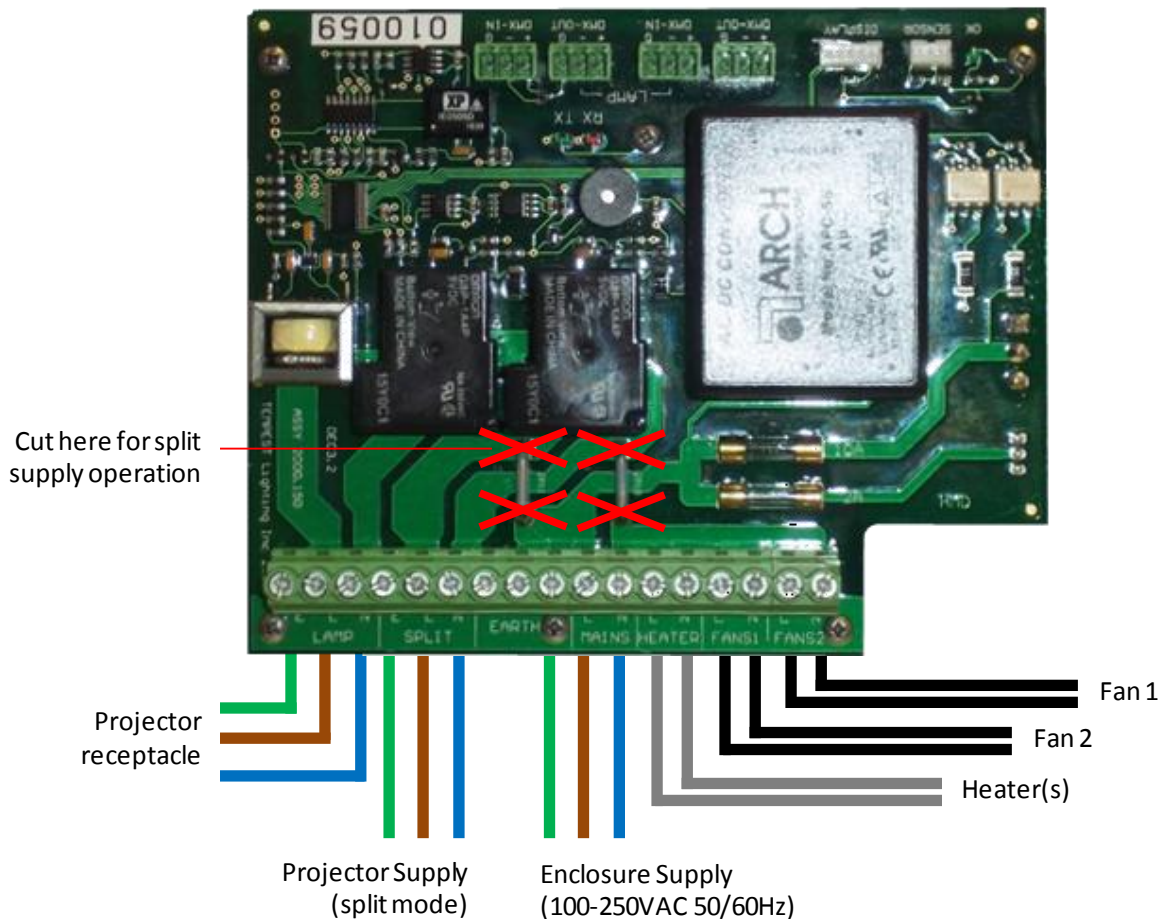
RDM refers to ANSI E1.20, a control protocol in the entertainment industry gaining popularity and essentially an “extension” of DMX512. The use of RDM is optional, and uses the same RS485 cable connection as DMX512, so no additional wiring is required.

It is the responsibility of the user to ensure that any DMX splitters or other routing devices used are rated for RDM as well as DMX use.

Power Connections

IMPORTANT Tempest enclosures are supplied for either 120VAC 50/60Hz, or 208–240VAC, 50/60Hz operation. Tempest Lighting is not liable for damage or failure to operate correctly due to connection to an inappropriate electrical supply.

ALL ELECTRICAL CONNECTIONS MUST BE UNDERTAKEN BY A QUALIFIED ELECTRICIAN, IN COMPLIANCE WITH LOCAL NORMS AND STANDARDS.



Note: wire colors may differ depending on applicable electrical standards. European wire colors are shown here.

MAKE SURE THAT TERMINAL SCREWS ARE FULLY BACKED OUT BEFORE INSERTING WIRES

Split or Common Supply Wiring

IMPORTANT: Tempest enclosures with any generation of DEC control MUST be powered 24/7, in order to protect equipment from condensation and temperature extremes.

The AC power feed must be adequate and appropriately fused/protected for the greater of the projector/light fixture load (see manufacturer’s instructions) and the Tempest enclosure (see enclosure manual). *Since the enclosure heater(s) never operate when the projector/fixture lamp is on, it is NOT necessary to rate the power service for the SUM of the enclosure and the projector/light fixture.*

Common Feed operation (factory default)

Tempest Enclosures are normally supplied wired for common electrical supply for the enclosure (DEC3.2) and the projector/light fixture to be enclosed.

Connect incoming power to the terminals labeled MAINS:

(E) Earth/Ground (L) Live (N) Neutral

Split Feed Operation

Split Feed allows you to run the projector/light fixture independently of the enclosure. **The enclosure must be powered 24/7.**

DEC3.2 normally ships from the factory with circuit card power links in place for a common electrical supply to feed the enclosure and the projector/fixture inside it.



To feed the enclosure and projector separately, you will need to remove the bridging links on the controller circuit board as shown in the illustration, before connecting to mains power.

Use a pair of small side cutters to cut the bridging links from the circuit board, taking care to not damage any tracks on the card.

When splitting the feeders, we strongly recommend feeding both supplies from the same phase and at the same supply voltage.

Feeds must be adequately dimensioned and fused for the loads used.

Connect incoming enclosure power to the terminals labeled MAINS. This supply MUST be maintained 24/7.

(E) Earth/Ground (L) Live (N) Neutral

Connect incoming projector/light fixture power to the terminals labeled SPLIT:

(E) Earth/Ground (L) Live (N) Neutral

Important – RDM and RDM Integration

DEC3.2's RDM implementation allows system integrators to set up remote control and status monitoring of all attributes and sensors, including:

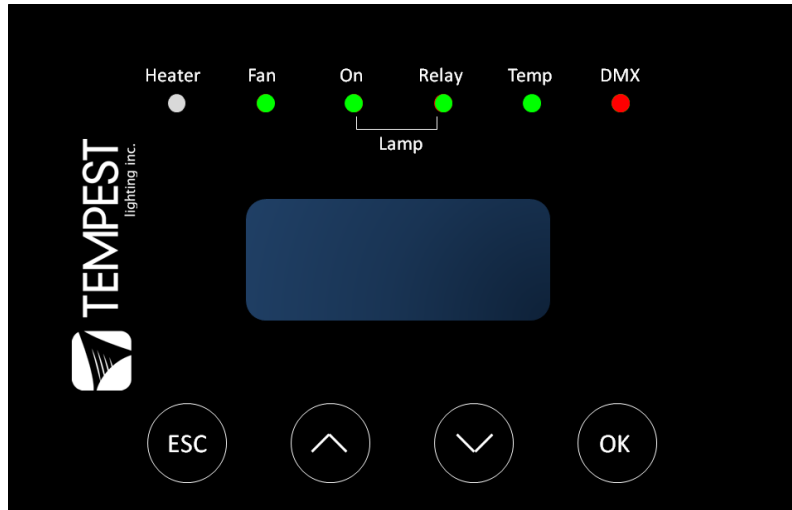
- Relative Humidity
- Air Temperature
- PCB Temperature
- Lamp Current
- Elapsed Lamp Hours
- Lamp Relay Status
- Fan Relay Status
- Heater Relay Status
- DMX Status
- DMX Start Address
- DMX Personality (RDM Mode)
- Device Type
- Device Label
- Software Version



RDM is an effective and powerful tool for commissioning and monitoring an installation, particularly in large systems. For further guidance, we recommend you consult a qualified RDM system integrator. If you don't have one in your neighborhood, go to www.tempestlighting.com, and click on the RDM and RDM Integration bug on the FAQ page for some useful contacts. Tempest Lighting warrants DEC3.2 to be compliant with the RDM standard, but is not an RDM systems integrator, and can offer only basic guidance on RDM utilization.

Control Interface

The control interface features a 2-line display, LED indicators, and 4 sealed control buttons.



LED Indicators

Heater

SHORT PULSES (Green) – Indicates lamp is off, and the heater is pulsing to prevent condensation inside the enclosure and projector/light fixture. This is normal operation when the lamp is off and the temperature range is above the bottom set limit. Timing intervals may vary – this is normal.

ON (Green) – Indicates heater is on, due to temperature being below bottom temperature setting when lamp is off.

OFF – indicates lamp is on and maintaining temperature above bottom limit.

Fan

SHORT PULSE (Green) – The fan is moving a little air through the enclosure, as part of the condensation prevention strategy. The fan comes on for a few seconds approximately every 30 seconds.

ON (Green) – Fan is running, due to lamp being on or internal temperature exceeding top limit.

Lamp On

ON (Green) Indicates current sensed on the lamp circuit greater than 0.5 amp (this allows some current to be drawn for such things as fans and control electronics without the Lamp On indicator lighting. When the Lamp On indicator is on, the lamp counter is counting lamp life.

Lamp Relay

ON (Green) – Indicates lamp relay closed and power is available to the internal fixture.

OFF Indicates lamp relay open and power is removed from the internal fixture.

Temp

ON (Green) - The temperature is between Bottom and Top temperature settings.

ON (Red) - The temperature is either:

- a) Below Bottom Setting
- b) Above Top setting but below the Cutoff level.

FLASHING (Red) - Temperature is above Cutoff level or below Bottom level.

DMX (Not used in BASIC Mode)

OFF - No DMX received (Basic Mode)

ON (RED) - DMX Fail

ON (GREEN) - Good DMX or RDM data packet received. Note that in Monitor Mode the DMX indicator will only be green when RDM packets are being received. In this case a RED LED is not indicating DMX failure, just that no data is being received from the RDM monitor.

Control Interface Operation

The Control Interface is normally LOCKED.

To UNLOCK, hold **ESC** and **OK** together for 5 seconds.

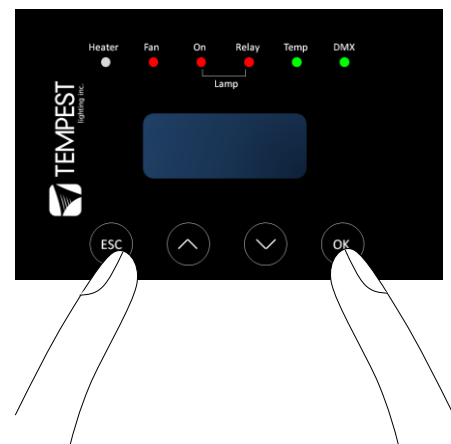
You are now in the **CONTROL MENU**

Use the arrow keys to scroll up and down the menu.

Press **OK**, to enter a menu item, then the arrow keys to set the item parameter, or to scroll to the next menu level.

Use **ESC** to back up a level, and **OK** to confirm settings.

To LOCK, hold ESC for 5 seconds. Menu will time out after ten minutes.



CONTROL MENU

SET DMX ADDRESS (in Monitor, DMX or Service modes)

Select a DMX starting address in the range 001 to 510

1 - Lamp Relay

In Service Mode an addition two slots are available

2 - Fan Relay

3 - Heater Relay

Note that the DMX control is designed using a SAFETY pile-on Logic. So the DMX input can only override automatic settings in a safe manner. For example, if the enclosure has switched off the lamp relay due to an over-temperature condition, the DMX input cannot switch it on, if the fans are running because of Overtemp, the DMX input cannot turn them off, and so on.

SET DMX MODE

RDM/DMX Mode may also be set using RDM commands to set the DEC3.2 DMX Personality.

From the Front Panel, this menu item allows the user to check (and if necessary change) the RDM mode.

BASIC	Standalone operation, no DMX/RDM (factory default)
MONITOR	Standalone, plus support for RDM remote configuration and monitoring
CONTROL	Monitor, plus use of a single DMX address to control Lamp relay
SERVICE	Monitor, plus use of three DMX slots to control Lamp, heater and fan

Important: Please ensure that the DEC3.2 is NOT unintentionally left in Service Mode.

STATUS DISPLAY

View current status information, using the arrow keys to scroll through:

- a) Humidity - relative humidity in %
- b) Firmware version
- c) Lamp Hours elapsed
- d) Current being drawn by projector/light fixture, in amps
- e) PCB temperature
- f) Air temperature, in degrees C or F (note that sensor is placed in the exhaust airflow in Tornado enclosures and may be higher than the temperature being 'seen' by the fixture body or electronics)

RESET LAMP HOURS

The lamp hour counter needs to be reset each time you change the lamp in the fixture/projector. Make this a part of your maintenance instructions.

HUMIDITY SET

The humidity level above which the heater kicks in to remove humidity from incoming air (default 80%, permissible range 50-90%).

SET FAN OVERRUN

The fan will continue to run for a time after the internal fixture has gone to standby. This facility allows the heat built up in the fixture to dissipate before the DEC3.2 resumes normal maintenance of the enclosure.

(default 5 minutes, permissible range 0-15 minutes)

SET TEMP RANGES

Set three temperature trigger points for Bottom, Top and Cutoff temperatures.

TEMP BOTTOM

The desired lower temperature limit for normal operation

(default 10°C, permissible range 0-10°C).

TEMP TOP

The desired upper temperature limit for normal operation

(default 40°C, permissible range 35-45°C).

When the DEC3.2 sees air above this temperature, but below the additional Cutoff temperature (see below), it indicates a temperature error. This is not dangerous.

TEMP CUTOFF

The desired upper temperature ABOVE the TOP TEMP setting, at which the lamp relay is forced to open, isolating the fixture/projector power.

(default 15°C, permissible range 0-15°C).

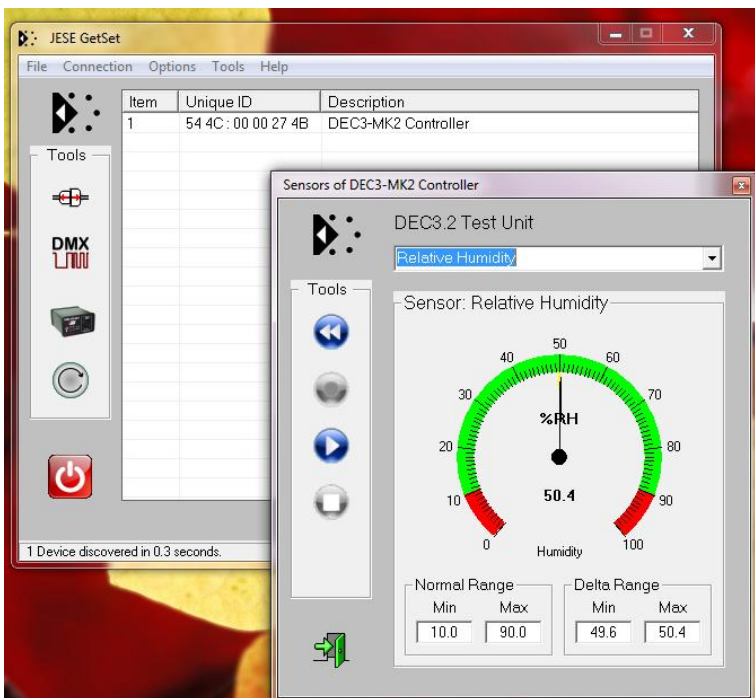
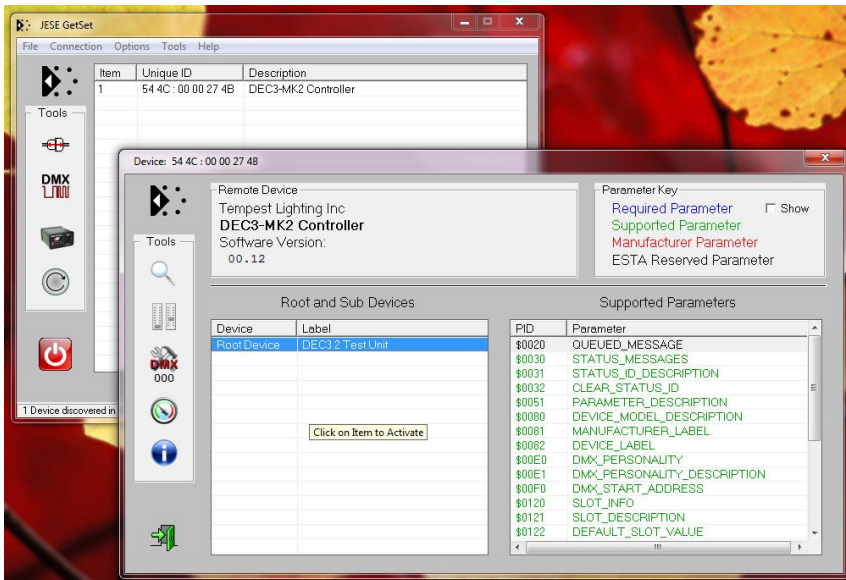
To avoid nuisance tripping, set this variable to the maximum, and monitor actual temperatures in your normal operating conditions. If your actual temperatures are running lower, then you may reduce the cutoff temperature margin. In hot climates, it may be advisable to set both TOP TEMP and CUTOFF TEMP as high as possible.

SET TEMP C OR F

Choose to display temperature values in Celsius or Fahrenheit (default Celsius)

RDM Monitoring and Configuration

All the features accessible over the DEC3.2 control panel are also available over RDM. Just how this information is displayed will depend on the RDM interface used. The following screen shots were taken running the GetSet program in Windows 7, and connecting to a DEC3.2 controller using a RDM TRI MK1 interface, both from JESE Ltd (jese.co.uk).

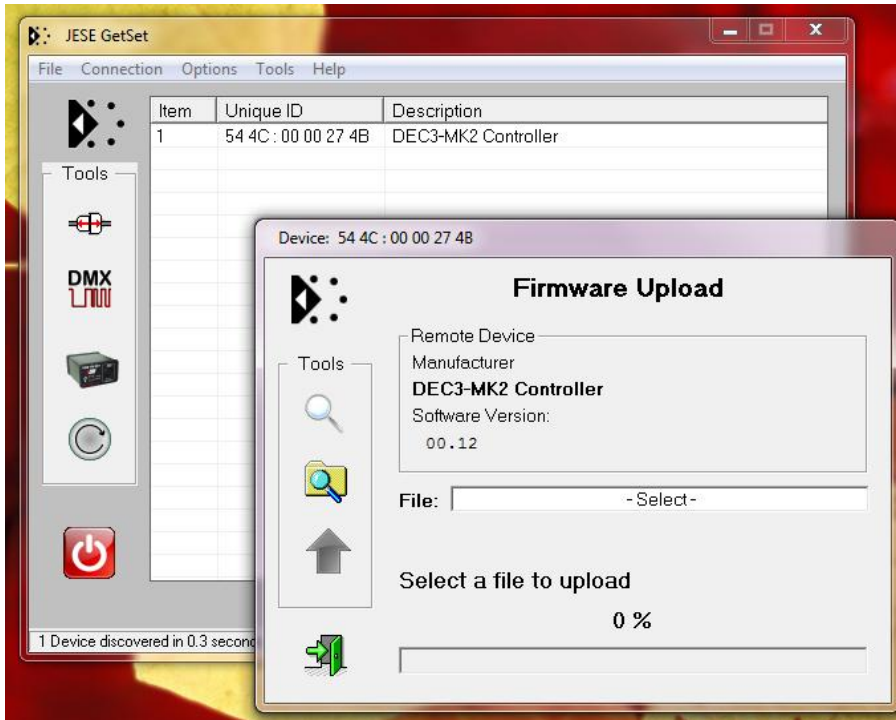


This view shows a single DEC3.2 test unit that has been correctly discovered and labeled by the GetSet software suite, and a log of RDM messages.

This RDM interface provides a graphic view of the various sensor functions supported by DEC3.2 (humidity, air temperature, pcb temperature).

There is a great deal of variability in the way RDM interfaces handle generic and manufacturer-specific information. We recommend asking your RDM interface vendor whether he has tested his interface with Tempest enclosures and all other RDM devices you plan to use on the same network.

Firmware Upgrade over RDM



DEC3.2 firmware is now field-upgradeable, using RDM. A field upgrade requires a JESE RDM TRI MK1 interface to be connected to the DMX network on which the DEC3.2 is located, and the use of JESE GetSet software.