

Unit 68: Automated Stage Lighting

Unit code:	R/502/5620
QCF Level 3:	BTEC National
Credit value:	10
Guided learning hours:	60

● Aim and purpose

The aim of this unit is to enable learners to develop the skills and practices required for working with automated stage lighting.

● Unit introduction

More and more venues are now equipped with automated lighting fixtures. These fixtures, often referred to as 'intelligent lighting', need very different installation and operating techniques from generic lighting equipment. This unit allows learners to explore and use this modern equipment. The skills involved are useful not only in the entertainment industry but also in conference and exhibition centres, nightclubs, retail and hotels.

This unit is useful for learners with existing generic technical skills who wish to extend their knowledge into more complex areas. It is also suitable for those who are new to the subject with no previous experience of theatrical or entertainment lighting. Only a few years ago, automated lighting equipment was prohibitively expensive. Prices have dropped and the equipment is now available to a wider range of venues, for example, small audience capacity part-time, civic style theatres, schools, colleges and amateur venues.

● Learning outcomes

- 1 Be able to rig automated equipment safely
- 2 Be able to carry out power and control circuit installation and connection
- 3 Be able to set up control systems to communicate with multiple fixtures
- 4 Be able to operate lighting controls during rehearsal and performance.

Unit content

1 Be able to rig automated equipment safely

Storage: flight cases; ancillary components; transport

Positioning: weight; installation procedures; safety procedures; power supply

Published data: specifications; reviews; images; drawings; price lists; accessories

Analysis: photometric data; comparisons; cost features; reliability; complexity

2 Be able to carry out power and control circuit installation and connection

Protocol: DMX 512; computer network protocols; legacy and non-standard protocols

Connections: 3/5 pin XLR; CAT5; manufacturer specific systems

Power: connectors; cable; distribution units; electrical safety

3 Be able to set up control systems to communicate with multiple fixtures

Set-up: patching; attributes; HTP/LTP; console customisation; show storage and retrieval

Controllers: types; features; channels; attributes; groups; palettes; masters

Power and start up processes: striking; re-striking; resets; fixture attribute and mode setting

4 Be able to operate lighting controls during rehearsal and performance

Functions: pan/tilt; intensity; gobo; rotation; prisms; focus; zoom and other parameters

Colour: wheels; CMY; RGB; colour correction

Movement: speed; shapes; lit and dark moves, mark or setup cues

Operation: programming; playback; scenes; pages; cues; stacks; effects; busking; editing

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 select and rig equipment safely with support and guidance [TW, EP, IE]	M1 select and rig equipment safely with minimal support and guidance	D1 select and rig equipment safely and competently without support and guidance
P2 install power and control systems with support and guidance [TW, EP]	M2 install power and control systems with minimal support and guidance	D2 install functional and effective power and control systems without support and guidance
P3 set up controls to successfully communicate with other fixtures [TW, EP]	M3 set up control to access attributes other than pan, tilt and intensity	D3 set up control using programme groups, palettes or other similar advanced features
P4 programme control with cues containing position and colour data [CT, SM, IE, RL]	M4 programme control with cues containing position, colour, beam and time data	D4 programme control with cues containing position, colour, beam and time data and carry out editing
P5 operate control using pre-programmed cues or scenes following stage management cueing, with support and guidance. [EP, SM, TW]	M5 operate control using pre-programmed cues or scenes reacting to visual and aural events, with minimal support and guidance.	D5 operate control with confidence and demonstrate the ability to react to unexpected events in a suitable manner without guidance.

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

It is possible for many of the key features of this unit to be delivered in controlled workshop-style sessions, but learners do need the pressures of working on real material, to short timescales, to reflect industry practice.

Learners will need time for individual experimentation with the equipment, in addition to workshop sessions. It is an advantage if centres have a smoke machine or hazer available during these sessions so that the light beams can be seen. Learners will need stimulus material in the form of music, dance and real productions to realise the work required for this unit. The practical application of automated lighting technology is often associated with music and dance and the integration of moving light with either or both of these art forms may provide a stimulating framework for learner activity. As an example, a music or dance performance could be lit in an artistic manner with the music or movement as the motivating factor, providing additional opportunities for assessment.

There is now a vast range of automated lighting equipment available and the setting up and patching elements of this unit makes the internet essential to gain access to manufacturer data and programming information. Understanding equipment specifications is a critical element for the selection element of this unit. During the delivery period of the unit, learners must be able to rig and operate at least four items of automated lighting equipment in the context of at least two different performances. There is an expectation that generic equipment will be used to supplement the automated equipment available.

Learners are expected to be able to construct effective powering systems for the equipment they use. Centres will need to provide suitable made up and tested cable and distribution systems for them to use. For this unit no in-depth electrical knowledge is required, the assumption being that the facility exists to supply power in a safe and industry typical manner to the various fixtures and accessories in their rigged position.

Safety information

Automated lighting equipment is heavy and requires suitable and safe systems to be in place to allow installation. Ideally, centres will have sufficient equipment and staff expertise available to allow learners to rig the equipment in typical locations – hung from lighting bars, attached to a truss or secured to purpose built mounting positions. Standard type risk assessments can often produce method statements and other safety documentation that allow this type of work to be carried out by learners under supervision. The unit specification requires learners to rig the equipment. It is not acceptable for them to direct a member of staff to do it. If rigging from the grid is deemed inappropriate by the centre, then it is permissible to rig equipment at a lower height as long as the learners still experience the difficulties of carrying out this process. As an example, if it can be arranged for a mounting position to be available at around head height for learners, this still provides sufficient difficulty and requires the use of mechanical assistance – usually pulleys/rope, etc. A mix of manageable tasks in this style, and staff-rigged equipment should allow access to the full range of grades.

Please note that the supervision detailed in this section is supervision from a safety viewpoint. This is different from the help and guidance style supervision that is a factor in the awarding of some criteria descriptors, where independent work is required for access to the higher grades.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to unit and structure of the programme – whole group.
Moving lights and what they can do – introductory session: <ul style="list-style-type: none">• powering up and striking up systems, dimming systems• pan/tilt• colour• gobos• other effects.
Selecting and rigging equipment: <ul style="list-style-type: none">• hanging fittings• safety bonds• rigging health and safety guide• techniques for rigging.
Assignment 1: Selecting and Rigging Automated Lighting – P1, M1, D1 (assessment sessions)
Introduction to power, DMX and other protocols: <ul style="list-style-type: none">• connectors• cable• power systems• connection types – star, loops, termination, repeaters and splitters/buffers• addressing• universes• attributes• patching.
Assignment 2: Installing Control and Power Systems – P2, M2, D2 (assessment sessions)
Introduction to lighting controls: <ul style="list-style-type: none">• hardware systems• software systems• operational concepts• popular systems• operational techniques• patching.

Topic and suggested assignments/activities and/assessment

Assignment 3: Set up and Patching – P3, M3, D3

(assessment sessions)

Workshop sessions:

- programming controls in rehearsal – basic functions
- programming controls in rehearsal – advanced functions
- programming controls in rehearsal – editing.

Assignment 4: Programming the Show – P4, M4, D4

(assessment sessions)

Assignment 5: Production Events – P5, M5, D5

Productions (these may be repeated at any point in the delivery period):

- theatre style events with stage management cues
- music style events – busking style
- complex or under rehearsed style – reacting to events.

Note: all learners need to experience as many different types of events as possible – repeat as necessary.

Repeat sessions for rigging and installation P1, M1, D1 and P2, M2, D2 – as required.

An opportunity for learners needing to improve grades only.

Repeat sessions for set up and programming P3, M3, D3 and P4, M4, D4 – as required.

An opportunity for learners needing to improve grades only.

Repeat session for operating controls P5, M5, D5 – as required.

An opportunity for learners needing to improve grades only.

Assessment

Evidence for this unit may be generated through a series of workshop sessions that introduce learners to the concepts and functions of the fixtures and controls. To carry out the activities required by the unit, learners will need to produce a portfolio of research material that will be used to facilitate the programming and planning phase of their work. This portfolio does not require assessment. Research skills are covered in many other units, and here the results of research are essential for achievement of many of the criteria. A permanent record of learners' achievements can best be made with photographic or video evidence of the effects or processes achieved in practical work. Written evidence from the learners would also be valid but it would be difficult to detail adequately the actual processes they used – whilst acceptable as supporting evidence, the production of this written evidence would be very time consuming, and centres must use their judgement to consider the usefulness of such written evidence. This unit is unusual in that perhaps the best evidence source is both still and moving visual evidence. This, coupled with their working documentation, should provide sufficient evidence for accurate grading. There is scope for notebook entries of the syntax required for control data entry to be used as evidence, if centres wish to incorporate a written element into the programme.

In this unit, the learning outcomes are split into the separate phases of work typically required when working with automated lighting.

- Learning outcome 1 is centred on learners understanding the specific problems of selecting appropriate equipment and rigging it in a safe and industry standard manner. To select equipment in an appropriate manner, learners need to understand the functions and operational style of the equipment in their inventory. For equipment that may be hired in, it is obviously essential that the equipment specifications can be compared to assess if it will be able to do the job it is being selected for.
- Learning outcome 2 relates to the setting up phase where learners will be connecting power and control circuits to the individual fixtures that they intend to control. Centres will have available sufficient cabling to allow learners to carry out this process efficiently.
- Learning outcome 3 is concerned with setting up control systems, patching them and making them communicate with the fixtures. This will require learners to have carried out research to gain the appropriate attribute lists and programming data they will need for this task.
- Learning outcome 4 is the final stage when learners can demonstrate their operation skills, working on productions of all scales. The operational styles will ensure they can cope with basic running cues and have the ability to create lighting in a busking manner. It also requires them to react to events as they happen.

Criterion 1 requires learners to select and rig equipment safely. In some cases, learners will require continual guidance and support during this phase. If this is the case, they may be awarded the P1 grade on completion of the activity. If the level of support and guidance is minimal, then this allows access to the M1 grade. Some learners may be able to complete this process independently with no input from staff members or other learners. If they are able to act in this manner then the D1 grade will be appropriate.

Please note that any input from staff due to centre restrictions on activities suitable for learners from a health and safety aspect should not compromise the grade awarding potential. As an example, the weight of a moving head usually requires in an educational environment that some physical assistance should be provided to rig or hang the fixture. A learner requesting assistance in this manner would not be considered as receiving support and guidance from an assessment perspective. The request for help is a common sense approach to dealing with heavy and awkward items that need to be lifted above ground level.

Criterion 2 is used to assess learners' ability to install power and control systems. Again, the key to grade progression is the amount of support and guidance they receive. Learners who can manage the power and control connections to enable a fixture to be powered up, and controlled under instruction would be able to achieve the P2 grade. If the level of support and guidance is minimal, then as with criterion 1, learners may be awarded M2. Learners who can carry out the process independently have reached the D2 grade level.

Criterion 3 relates to learners being able to set up a lighting control system that can communicate successfully with the fixtures installed. The P3 grade will be appropriate for learners who can carry out the set up phase and control basic functions such as pan/tilt and intensity. If learners can access more advanced features other than the basic ones required for the P3 grade, such as colour, gobo and other features, then the M3 grade is available. Advanced features such as palettes and programme groups are the key to accessing the D3 grades. Being able to use these advanced features is a good indication of work at distinction level.

Criterion 4 will normally be evidenced when learners are plotting for a show. They will be responding to the needs of the production, entering a number of different states or scenes as the rehearsals progress. Recording of basic positional and colour information is the requirement for the P4 grade. Being able to add in beam control, such as the use of gobos or focus, alongside timing information as to cue duration is the key to learners being awarded the M4 grade. Learners who can show the ability to edit stored states or scenes to meet the demands of the production may be awarded the D4 grade.

Criterion 5 is covered during the operating phase, for real (or simulated) productions. Learners who can step through pre-programmed scenes – either previously programmed by themselves or other learners – may be awarded the P5 grade if guidance and support was provided. Note that directions from a stage manager using ‘GO’ cues do not constitute support and guidance in the context of this criterion, being standard practice. Repeated guidance in carrying out the ‘GO’ cue would restrict the grade awarded to the P5 level. Once learners can demonstrate their need for minimal guidance, and show some evidence of being able to react to visual as well as aural events they may be awarded the M5 grade. As a guide, learners who react to verbal stage management cues and visual cues – such as an actor switching on a light switch – would have satisfied the requirements for visual and sound events. Learners who are confident and have demonstrated their ability to react to events both planned and unplanned meet the requirements for an award at D5 grade.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, M1, D1	Selecting and Rigging Automated Lighting	Learners are being assessed choosing and rigging equipment.	Video recordings. Photographs. Assessor observation.
P2, M2, D2	Installing Control and Power Systems	Learners are installing systems to enable control and operation.	Video recordings. Photographs. Assessor observation.
P3, M3, D3	Set up and Patching	Learners will be setting up the system to enable the controls to communicate with the fixtures.	Learner notes. Attribute lists. Patching diagrams/lists. Video/audio recordings. Assessor observation. Photographs.
P4, M4, D4	Programming the Show	Learners will be programming the lighting in a simulation or real production.	Scripts. Running orders. Photographs or other images. Screenshots. Assessor observation.
P5, M5, D5	Production Events	Learners act as lighting operator/designer for a range of events.	Scripts. Running orders. Video recordings. Screenshots. Assessor observation.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Performing and Production Arts sector suite. This unit has particular links with the following unit titles in the BTEC Performing and Production Arts suite:

Level 1	Level 2	Level 3
Exploring Technical Support for Stage Performance	Lighting Operations for Stage Performance	Production Arts Workshop
		Stage Lighting Operations
		Stage Lighting Design
		Technical Theatre Operations
		Temporary Theatre Electrical Installations

This unit also has links with the following National Occupational Standards:

Technical Theatre

- HSI – Working safely
- TP8.2 – Setting up, focussing lighting and checking control systems and accessories
- TP16 – Preparing and assembling rigging and de-rigging
- TP20.2 – Operating lighting for a live performance in the theatre.

Essential resources

This unit requires specialist equipment to be available to learners. It is recognised that this equipment will be expensive to resource but centres should not attempt this unit without appropriate technical facilities. It is suggested that centres should have a limited range of equipment as part of their permanent inventory. Additional equipment could be hired in for short periods for specific purposes. The following section should be used as a guide to the minimum level of equipment required to allow learners to achieve.

Four moving head or moving mirror fixtures with independent control of intensity, colour, gobo selection and gobo rotation are required. Remote control of focus, prism type effects, CMY colour mixing and other advanced features are desirable, but not essential. In addition, at some time during the programme, learners should have access to at least a further two fixtures. These extra fixtures may be of a reduced specification but should still have a basic complement of features. This will allow a minimum of six fixtures to be controlled by learners to complete their studies. Colour scrollers, LED fixtures and similar devices are considered additional to these minimum standards. A hazer or smoke machine is a valuable tool to allow the visual effect of the lighting to be seen. A control system capable of operating the available fixtures must be available. This may take the form of a dedicated moving light controller, preferably a controller that is able to handle both automated fixtures and conventional generic lighting equipment. In this case the controller must have dedicated attribute handling facilities. A general DMX control is not suitable as programming automated lighting in this manner is difficult and time intensive and does not allow industry practice to be followed. It is the intention that learners completing this unit are equipped to move into a professional lighting environment and able to translate their knowledge to different styles and manufacturers of equipment. It is critical that centres emphasise the diversity of equipment commonly found in the industry and do not direct learners into working practices centred on particular brands of equipment.

The use of PC-based control software, rather than traditional hardware controllers, is permissible but must be capable of functioning in the same manner as a hardware control having proper manual faders and button operation. A PC control, using a proprietary DMX interface, is a legitimate control tool, but the theatrical use of lighting still requires a manual, tactile control surface. The addition of a manual fader panel to PC software is acceptable if learners are to be able to, for example, operate a number of faders, bump buttons, etc simultaneously without using a mouse or touch pad. It is appreciated that there are professional circumstances where a PC-based system is appropriate, but this unit requires learners to be able to use manual control – something not always practical with software-based systems. The focus of this unit is the end product made possible by the equipment.

Employer engagement and vocational contexts

Centres should develop links with local theatres, amateur production companies and other entertainment venues. Centres with learners aged under 16 need to be aware that placements or real work experience are rarely available in theatres due to legal restrictions.

Indicative reading for learners

Textbooks

Coleman P – *Basics: Beginner's Guide to Stage Lighting* (Entertainment Technology Press, 2003)
ISBN 9781904031208

Morgan N – *Stage Lighting for Theatre Designers* (Entertainment Technology Press, 2003)
ISBN 9781904031192

Offord J – *Lighting for 'Romeo and Juliet': Patrick Woodroffe at Vienna State Opera* (Entertainment Technology Press, 2002) ISBN 9781904031161

Schiller B – *The Automated Lighting Programmer's Handbook* (Focal Press, 2004) ISBN 9780240806020

Staines J – *Lighting Techniques for Theatre-in-the-Round* (Entertainment Technology Press, 2000)
ISBN 9781904031017

Simpson R – *Lighting Control: Technology and Applications* (Focal Press, 2002) ISBN 9780240515663

Websites

www.abtt.org.uk

Association of British Theatre Technicians

www.ald.org.uk

Association of Lighting Designers

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Creative thinkers	programming control systems
Team workers	selecting and rigging equipment
Self-managers	operating lighting controls for performance
Effective participators	setting up controls to communicate with fixtures.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	selecting appropriate equipment for a particular task
Reflective learners	programming control systems.

● Functional Skills – Level 2

Skill	When learners are ...
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	researching the specifications of equipment and downloading appropriate fixture libraries and attribute lists
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	preparing patching systems and setting binary codes on dip switches
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	working with members of the production team and responding to instruction and cues where precise language is required
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading complex equipment manuals and programming controls and fixture to enable communication and select protocols.