

Unit 69: Stage Sound Operations

Unit code:	A/502/5644
QCF Level 3:	BTEC National
Credit value:	10
Guided learning hours:	60

● Aim and purpose

This unit enables learners to develop the skills and practices required to use sound equipment to support a production.

● Unit introduction

The theatre and entertainment industry have a requirement for people skilled in the selection, installation and operation of a large variety of specialised sound equipment. Members of the general public are very aware of both the quality and 'type' of sound found in venues of all sizes, covering a wide range of genres. This unit is designed to provide essential skills across this wide range of applications. The unit content covers both the theory and practical elements necessary to be a useful member of a production team, and engage in individual work that will produce some of the common audio products such as sound effects, recordings, backing and click tracks, editing and playback. These essential skills can be used if learners go directly into the industry or as a good grounding for further study at a higher level.

The unit is suitable for study by a newcomer to the sound area of production and can also be a useful method of gaining additional skills for someone already working in the industry in a different area – lighting and staging are good examples. Prospective learners should also note that many of the skills developed in this unit are transferable to work in associated areas. Nightclubs, churches, exhibition centres, public buildings, radio and television all require staff with a thorough working knowledge of sound operation techniques. It may be possible for some of the assessed work to be carried out at local venues or other suitable locations. Amateur and professional work experience will enhance the opportunities for learners to demonstrate their sound skills and integrates easily into the unit structure.

There is some commonality between this unit and *Stage Sound Design*, but the focus is very different. This unit is designed to build learner skills in the functional areas of sound. They will be able to correctly connect equipment, carry out recording processes and act as sound operator for performance. *Stage Sound Design* uses these fundamental concepts and relates them to performance where being able to fulfil a design remit is the critical factor. The design unit has a focus on the production process and sound for many different performance genres. Centres may offer either or both of the units to suit their requirements. There is no requirement to study this unit before *Stage Sound Design*, although this is an ideal progression route through this study area.

● Learning outcomes

On completion of this unit a learner should:

- 1 Be able to evaluate the acoustic properties of a performance venue
- 2 Be able to demonstrate skills in recording techniques and associated technology
- 3 Be able to provide sound for performance.

Unit content

1 Be able to evaluate the acoustic properties of a performance venue

Sound: wavelength; frequency; amplitude; direction; fundamentals and harmonics; octaves; frequency response; decibels (dBs); human voice and hearing

Acoustics: natural and artificial reverberation; reflection; absorption; insulation and isolation

Transducers: microphone types; pick-up patterns (polar diagrams); selection and use; loudspeaker types; active and passive crossovers; connectors and cable; flying systems

2 Be able to demonstrate skills in recording techniques and associated technology

Microphone technique: stands; positioning; instruments; cabling; cable safety; DIs

Sound mixers: analogue/digital equipment; gain; polarity (phase); auxiliaries; inserts; sub groups; meters; monitoring; busses

Systems: the recording process; analogue/digital recording; signal processing; data compression and reduction; synchronisation; storage media; hardware/software systems

Products: backing tracks; click tracks; sound effects; scene setting music or effects; information and safety announcements

3 Be able to provide sound for performance

Rigging: get-ins/outs; set-up and placement; line checks; monitors; sound-check; safety

Equalisation: parametric; band pass; graphic; feedback reduction

Radio microphone systems: types; licensing; antenna systems; diversity; frequency setting; RF theory and techniques; specialist microphone types; operation techniques

Amplification: power supply; power output; impedance matching; levels; distortion

Operation: role of sound operator in production and performance; cue sheets; scripts and documentation; faultfinding

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 criteria for a pass grade describe the level of achievement required to pass this unit.

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 carry out an evaluation of the acoustic properties of a performance venue [IE, SM, RL]	M1 carry out an evaluation of the acoustic properties of a performance venue with some attention to detail using industry typical language	D1 carry out a comprehensive evaluation of the acoustic properties of a performance venue, suggesting solutions to improve the acoustics
P2 set up recording equipment under supervision and produce material that is fit for purpose [TW, SM]	M2 set up recording equipment with minimal support and produce material which shows an awareness of the needs of a performance	D2 set up recording equipment independently and produce material which shows a detailed awareness of the needs of a performance
P3 select and set up appropriate PA equipment, showing an awareness of basic functions and specifications [CT, SM, TW]	M3 select and set up PA equipment with minimal support showing an awareness of advanced functions and specifications	D3 select and set up PA equipment with minimal supervision showing a detailed awareness of functions and specifications
P4 produce sound for performance that is fit for purpose. [CT, EP, SM]	M4 produce sound for performance which shows an awareness of the needs of a specific production.	D4 produce sound for performance which shows a detailed awareness of the needs of a specific production.

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

The specification requires learners to select and set up appropriate equipment and will need to carry out research. Much of the technical specification information may be available on manufacturers' websites and in easily available technical literature. Some of the unit content requires access to conventional teaching space but much of the work is best carried out in a performance space where the equipment is perhaps semi-permanently set up, avoiding wasting time constantly moving equipment from store to teaching area and returning afterwards. The unit requires learners to be able to work individually and in small groups. This is most appropriate when providing sound services to other groups of learners within the centre or externally, for example when assisting at a local venue, perhaps with a music event. The nature of the unit, and many of the assessment processes required, has health and safety implications; centres must ensure that all learner activity is carried out with suitable precautions in place.

The essential components of the unit should allow learners to be able to identify equipment, assess its suitability and produce a simple plan for its use. They will then rig the equipment and operate it.

Much of the learning will take place in short theory sessions, with reinforcement and experimentation during the practical sessions that follow. If learners are working on individual projects it is critical that the assessors monitor the progress of each learner regularly.

Please note that, in some cases, working externally in a venue licensed by the local authority may not be possible for learners under the age of 16. Centres are advised to consult the current regulations for advice on under 16s working in a theatre environment.

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 gives an indication of the volume of learning it would take the average learner to achieve the learning outcomes. It is indicative and is one way of achieving the credit value.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Introduction to unit and structure of the programme – whole group.
Examples of productions with sound effects, backing tracks, click tracks.
Mixing practice – mixing pre-recorded tracks – eq and fx.
Introduction to microphones and recording/PA equipment.
Karaoke evening – planning for a production – likely problems/solutions.
Assignment 1: Select a Venue and Evaluate the Acoustic Properties – P1, M1, D1
<ul style="list-style-type: none">• Allocate/agree venues/spaces.• Acoustic feature – good/bad/music genre/problems.• Visit venues/spaces.• Produce written or videotaped report.
Basic principles – microphone techniques, mixers and recording equipment.

Topic and suggested assignments/activities and/assessment

Assignment 2: Produce a Backing Track Using a Number of Sources – P2, M2, D2

- Source midi backing track.
- Add real instruments.
- Produce mix suitable for performance.

Basic principles – PA systems – loudspeakers, amps and monitors.

A Night at the Musicals – planning for concert series – likely problems/solutions.

Sound mixing for shows:

- equipment
- radio microphones
- techniques.

Assignment 3: A Night at the Musicals Show Series – P2, M2, D2, P3, M3, D3, P4, M4, D4

Each learner to:

- liaise with singer and produce backing track
- set up equipment for show
- operate equipment for show.

Production 1: The Tempest Activity – P2, M2, D2, P4, M4, D4

- Produce ideas for an 8-minute background tracks for the island.
- Produce sound effects and music as required.
- Present the recording to the other groups.

The Tempest – assessment of recordings – grades and comment.

Assignment 4: The Concert – opportunity to revisit all criteria

Part 1 pre-production:

- visit the venue to check sizes and test acoustic properties
- analyse visit and evaluate the venue for suitability and problems
- plan recording equipment for CD to be sold for charity
- plan PA equipment for live audience.

Assignment 4: The Concert

Part 2 production:

- record concert (team 1)
- produce live sound for concert (team 2).

Introduction to click tracks.

Radio microphone systems – introduction and workshop session.

Assignment 5: Radio Microphones – P3, M3, D3, P4, M4, D4

- Mark up script – all learners.
- Rotating workshop style operation session – includes setting up equipment, personal microphone placement on actors and mixing a short complicated script session with entrances and exits.

Topic and suggested assignments/activities and/assessment

Stage monitoring – introduction:

- purpose
- equipment
- problems
- solutions.

Production 2: Major Production: Musical – P1, M1, D1, P2, M2, D2, P3, M3, D3, P4, M4, D4

- Planning – venue issues and solutions.
- Sound effects and background sounds required.
- Sound system design for the production.
- Source equipment and plan physical elements.
- Record all necessary material.
- Install equipment.
- Carry out pre-production tasks.
- Carry out rehearsal tasks.
- Operate sound for performance.

Revisiting criteria – additional sessions on areas where distribution of roles, or real project conditions, prevented learners having access to individual criteria.

Review unit and assignments.

Feedback from assignment.

Assessment

The nature of sound operations for the stage does not offer many opportunities for group activity – it is difficult to mix at a sound desk if more than one learner is attempting to balance sound. Sometimes, with planning it may be possible to split the task, allowing perhaps one learner to mix the orchestra or band while another balances a number of vocalists. This typically requires the centre to rotate learners carefully through a number of different events to allow everyone to practise their skills and develop techniques that will allow access to the higher grade levels. It may be possible to use simulations or rehearsals for the practice elements, making the actual show into an assessed activity. Video or audio recordings are a good method of providing evidence for assessment. If a centre chooses to run a bigger production towards the end of the programme, this also provides additional assessment opportunities. Assessment criteria may be interpreted as relating to many different roles within a production. The obvious role of sound engineer, out front with the audience is the usual role, but the criteria also allow for an assistant on stage, perhaps looking after radio microphone systems, or another learner tasked with running the on-stage sound with monitors and instrument amplifiers under their control. All these roles can meet the 'produce sound for performance' requirement. Group activity may take place in the set up phases, but assessors need to make sure evidence to support an individual grade for each learner is collected.

Learning outcome 1 is concerned with the basic principles of sound and acoustic theory. This knowledge is important as it underpins the work carried out in the entire unit. Assessment for this area of study concentrates on evaluating acoustic properties of spaces where performance could take place. All of the areas contained within learning outcome 1 have a direct or indirect link to acoustic properties. Learners will use their knowledge of acoustics to evaluate the different spaces they will work in.

Learning outcome 2 deals with the skills and techniques required for recording audio. These recordings can be in many forms. Complete backings for singers, or click tracks used to enhance a smaller band are typical examples although Sound Effects (SFX) production is also covered by the specification, as is recording the spoken word for announcements or narration. Some learners may have music composition skills, while others may source material from external sources. Background tracks designed to set a scene in a subtle manner may be another area covered by this outcome. Assessors need to ensure that they are assessing what learners have done, not the work of someone else, so learner logs or other evidence may be helpful in allowing the assessor to determine which components are each learner's, and contribute to their assessment, and those that were simply carefully chosen and not edited or treated in any way.

Learning outcome 3 relates to setting up PA equipment. This activity is a common feature in many centres, but the requirement for this outcome is that learners select the appropriate equipment themselves, then set it up and make it operate. This requires a basic understanding of the elements covered in learning outcome 1 to be able to carry out the process. Centres may also wish to make provision for monitoring health and safety issues during this phase, as learners may be using heavy and awkward equipment. Physical aspects of this process are outside of the scope of this specification.

Learning outcome 4 is concerned with the final process, providing the sound for performance. The notes above show that centres may use the term 'produce sound' in any appropriate manner that relates to learners carrying out the end process of making the sound element of a production happen. It is not linked to complexity of task, or the duration of the show. Assessors need to ensure that each learner is given the opportunity to access all available grade levels during the delivery period of the unit, with some scope to repeat activities to allow for grade improvement.

To achieve P1, learners need to be able carry out an evaluation of the acoustic properties of a performance space. At pass level they must be able to determine correctly if a space has dead or live acoustics and determine the reason. If learners are able to make the link between larger spaces, hard surfaces, reflections and reverberation they have demonstrated appropriate usage of industry standard language and meet the M1 requirement. If they are able to suggest methods of controlling the acoustics, or perhaps methods of reducing the impact of any problems, they may be awarded the D1 grade.

Criterion 2 requires learners to set up recording equipment and then use it to make a recording. For learners working at P2 standard, it is likely this process may have to be directed by the tutor or another learner with higher level skills. As long as learners carry out the physical set up tasks as well as the actual recording process the P2 grade may be awarded. The material produced must still be of a quality that allows it to be used. The practical view would be that if the produced material cannot be used, then learners have not yet met the pass level for this unit for criterion 2. The complexity and variation in equipment types does mean that learners may have to have occasional guidance throughout their work. M2 requires learners to take into consideration the needs of the performance, which may entail a more complex product. Assessors must use their professional judgement to decide if the guidance provided can be termed minimal. As an example, simple equipment with very basic operational style and very simple connections would not be the same difficulty level as connecting multiple microphones to a complex piece of modern digital recording equipment, where the expectation of error is higher. Assessors need to take the difficulty level into consideration when deciding if the M2 grade is appropriate. IV and EV processes will need to take the equipment complexity into account when carrying out verification, making evidence that shows the process important. Video evidence could be useful in showing the difficulty level. A learner working independently is the requirement for the D2 grade, coupled with the detailed understanding of the features the production needs.

Learners working on criterion 3 need to select and set up PA equipment. Centres must have PA equipment available that allows some scope in learners identifying appropriate components. This could be some different types of microphones, stands, cables alongside the main mixer, amplifier and loudspeaker components. For P3 to be awarded learners must select appropriate components for the task and then set them up into a complete and working system. At P3 level, this may be under guidance from a member of staff or another learner if appropriate. If the system functions and can be used then P3 can be awarded. If the guidance is minimal, and some of the more advanced features of the equipment are used by the learner, then M3 grade is available. As with criterion 2, independent work is the key to gaining a D3 grade. At this level, learners will be able to show a detailed understanding of the functions and specification of the equipment they are using.

Criterion 4 is the end product of the set up process in most cases. Learners will control the equipment during a performance. The key feature in the assessment is control. The P4 grade cannot be awarded if learners do not demonstrate some control over the process they are carrying out. For learners at a sound desk, this means that adjustment of fader levels or effects is evidence of control. Avoiding feedback and the playback of audio media are all evidence of the learner being in control. If a learner operates the show and produces sound that is fit for purpose, then a P4 grade may be awarded. Small slips should not prevent the grade being awarded, but major lapses in control that have an impact on the performance may be an indication that the end product was not fit for purpose, and the P4 grade has not yet been reached. A learner who demonstrates the ability to understand the needs of the production, perhaps by fading a background sound to allow a performer speaking unusually quieter is evidence of meeting the M4 grade. A learner who is able to balance a number of instruments to allow quieter ones to be heard, while pulling back overloud ones has a detailed understanding of what should happen during a performance, and will be awarded a D4 grade. As detailed in this section, other performance-related roles may be assessed using this criterion. A learner tasked with fitting radio microphones to a performer, ensuring the correct one is fitted, would also be a process that can be assessed with criterion 4. If the learner fits the correct microphone, as per rehearsals, then a P4 grade is appropriate. Learners who can react to problems, perhaps swapping faulty units in a hurry, can be awarded the M4 grade, and those learners capable of predicting problems due to microphone placement or other similar issues can be awarded the D4 grade. A number of different sound related roles can easily be assessed by criterion 4 and centres are encouraged to follow industry practice and create proper sound roles for their productions.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the 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	Assignment 1 Venue Acoustic	As a sound technician, learners will be assessing the acoustic properties of a venue.	<ul style="list-style-type: none"> Learner evaluation of venue.
P2, M2, D2	Assignment 2 Produce a Backing Track	As a sound technician, learners source a MIDI backing track and add real instruments.	<ul style="list-style-type: none"> Assessor observation. Finished track.
P2, M2, D2, P3, M3, D3, P4, M4, D4	Assignment 3 A Night at the Musicals	As a sound technician, learners produce a backing track and after setting up equipment, operate for the show.	<ul style="list-style-type: none"> Assessor observation. Video/audio recording.
P2, M2, D2, P4, M4, D4	Production 1 The Tempest	As a sound technician, learners produce an 8 minute background track for the show and use it in a production with report.	<ul style="list-style-type: none"> Assessor observation of operation. Audio recording. Learner report.
P1, M1, D1, P2, M2, D2, P3, M3, D3, P4, M4, D4	Assignment 4 The Concert	As a sound technician, learners evaluate a venue, plan for a performance event, produce a charity CD and operate live sound for the event.	<ul style="list-style-type: none"> Assessor observation. Learner documentation. Audio products.
P3, M3, D3, P4, M4, D4	Assignment 5 Radio Microphone	As a sound technician, learners experiment with operating radio microphone systems – assignment carried out in workshop setting.	<ul style="list-style-type: none"> Assessor observation. Marked-up scripts. Video recording.
P1, M1, D1, P2, M2, D2, P3, M3, D3, P4, M4, D4	Major Production	As a sound technician, learners carry out sound duties for a major production.	<ul style="list-style-type: none"> Assessor observation. Learner documentation. Audio products. Video/audio recording.

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
	Sound Operations for Stage Performance	Stage Sound Design
		Production Arts Workshop
		Technical Stage Operations
		Live Sound for the Stage

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

Technical Theatre

- CPD1 – Improving your skills
- CPD2a – TP Keeping up to date with technical and production developments in the live arts
- CPD4a – Contributing to technical production work for performance
- HSI – Working safely
- TP3.6a – Contribute to the planning of sound requirements for a production
- TP3.6b – Planning sound requirements for a production
- TP8.4 – Setting up and checking sound equipment
- TP20.4a – Operating sound for a live performance in the theatre.

Essential resources

The resources required for this unit are similar to those required for *Stage Sound Design*.

This unit requires a basic level of equipment to be available to learners. As a guide the following list should be used as a guide to the minimum level of equipment needed to allow learners to achieve a full range of grades. Centres should have available equipment that allows learners to provide the types of services found in modern entertainment technology applications. This consists of recording and PA equipment. The expectation is that learners will be able to use more complex equipment at Level 3 than at Level 2.

For recording, learners require access to hardware or software recording systems capable of handling multi-channel sound. In the context of this unit, this should be a minimum of eight discrete tracks, although most software-based systems are capable of more than this. Equipment must be able to handle both microphone and line level sources and be capable of supplying phantom power. DI boxes, dynamic and condenser microphones should be available, along with typical accessories such as stands, cables and basic test equipment. Computer-based editing facilities are required and access to external media sources for sound effects and other useful source material should be available.

Learners need to have access to radio microphone systems during the delivery period of this unit. These may be hired in for specific productions if not permanently available.

Learners need to use suitable PA systems for the duration of this unit. These systems will obviously need to be suited to the venues available to the centre, but as a guide are likely to be passive or active systems with extended bass response, capable of delivering sufficient volume to suit the genre of performance. Wherever possible, the system will mimic the operational style of bigger systems found in common use within the industry. A simple portable plug-and-play budget system is unlikely to be suitable for use within this unit. There is no requirement for digital state of the art equipment as long as the equipment available is in good condition and can provide the facilities required to allow access to all grade areas. Proper monitoring systems are essential for learners to demonstrate their skills in mixing both front of house sound, but also mixing monitors for performers. Although a modern digital mixer may appear to be advantageous, it is possible to complete this unit successfully using a basic small format analogue mixer of professional quality as long as it has a sufficient number of inputs and outputs. Facilities such as graphic eq, compressors and limiters and signal processing need to be available for use by the learners.

Employer engagement and vocational contexts

Centres should develop links with local theatres and other entertainment venues. Centres with learners 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

Davis G and Jones R – *The Sound Reinforcement Handbook* (Hal Leonard Publishing, 1990)
ISBN 9780881889000

Fraser N – *Lighting and Sound Theatre Manual* (Phaedon Press, 1988) ISBN 9780714825144

Stark H – *Live Sound Reinforcement* (Course Technology, 2004) ISBN 9781592006915

White P – *Basic Live Sound* (Sanctuary Publishing, 2000) ISBN 9781860742712

White P – *Basic Mixers* (Sanctuary Publishing, 2000) ISBN 9781860742668

White P – *Basic Mixing Techniques* (Sanctuary Publishing, 2000) ISBN 9781860742835

White P, Mead D and Gladwell R – *Studio Recording Basics A (Basic Mixing Techniques, Effects & Processors, Multitracking & Mixers)* (Sanctuary Publishing, 2002) ISBN 9781860744730

White P – *Recording and Production Techniques* (Sanctuary Publishing, 2002) ISBN 9781860744433

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	selecting and setting sound systems
Team workers	working together to set up and install equipment
Self-managers	evaluating acoustics and producing sound for performance.

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	carrying out research and visiting venues
Team workers	assisting other learners with their roles.

● Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	using computer-based recording equipment to generate material to be used in a production, or using it to edit and manipulate sound in the pre-production process
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	researching acoustic properties, or deciding on the technical requirements of equipment to be sourced – technical specifications and physical size data
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	considering reverberation times likely in buildings of known size with typical acoustic properties
Identify the situation or problem and the mathematical methods needed to tackle it	using appropriate calculations to set rough delay times for loudspeaker time delays
Select and apply a range of skills to find solutions	comparing predicted acoustic properties with those found on site by measurement
Use appropriate checking procedures and evaluate their effectiveness at each stage	
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	
Draw conclusions and provide mathematical justifications	
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	responding to the requests of the producer, director or other production team members
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	using published equipment specification to prepare hire lists, budgets and production documentation.