National Unit specification

General information

Unit title: Sound: Understanding the Signal Path

Unit code: H7F9 46

Superclass: KG

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Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to introduce learners to the journey that sound travels from a performer, through an audio system, to a listener. Learners will have an opportunity to examine sound at each stage of the signal path, namely as it exists as acoustic energy, is then converted into electrical form (both digital and analogue) and then back to acoustic form. In addition, learners will consider some basic aspects of human hearing including audible frequency and sound pressure level ranges and the health and safety implications of sound on the listener.

Learners will be given the opportunity to learn about basic properties of sound waves and their journey through analogue and digital systems and will have the opportunity to put theory into practice and acquire practical skills in connecting and testing typical small scale audio systems, taking into account any health and safety issues.

This Unit is a mandatory Unit within the National Certificate in Sound Production (SCQF level 6), but can also be taken as a free-standing Unit.

This Unit is suitable for learners wishing to acquire a basic understanding of the theory and practice of small scale audio systems.

Outcomes

On successful completion of the Unit the learner will be able to:

1 Explain the path of a sound wave from the performer to the listener.
2 Connect devices within an audio system in accordance with a given brief.
3 Test given audio systems to ensure correct and safe operation.

National Unit specification: General information (cont)

Unit title: Sound: Understanding the Signal Path

Credit points and level

1 National Unit credit at SCQF level 6: (6 SCQF credit points at SCQF level 6)

Recommended entry to the Unit

As this is an introductory Unit, entry is at the discretion of the centre. Learners would not be expected to have any prior knowledge or experience of how sound travels through systems, or the function and operation of sound reinforcement or recording systems.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

This Unit is a mandatory Unit within the National Certificate in Sound Production, NPA Sound Production — Recording and NPA Sound Production — Live (SCQF level 6), but can also be taken as a free-standing Unit.

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**.

National Unit specification: Statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Outcome 1

Explain the path of a sound wave from the performer to the listener.

Performance Criteria

(a) Explain the properties of sound waves in air.
(b) Explain basic aspects of human hearing.
(c) Explain the role and operation of transducers in the signal path.
(d) Describe the properties of analogue and digital signals in an audio system.

Outcome 2

Connect devices within an audio system in accordance with a given brief.

Performance Criteria

(a) Select correct cables in accordance with the brief.
(b) Connect devices correctly.
(c) Comply fully with health and safety requirements.

Outcome 3

Test given audio systems to ensure correct and safe operation.

Performance Criteria

(a) Carry out a visual inspection of the system prior to system power up to identify and remedy faults.
(b) Power up systems in the correct sequence.
(c) Set levels using appropriate gain structures and metering.
(d) Comply fully with health and safety requirements.

National Unit specification: Statement of standards (cont)

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Evidence Requirements for this Unit

Evidence is required to demonstrate that learners have achieved all Outcomes and Performance Criteria.

Written and/or oral evidence is required for Outcome 1. The instrument of assessment will provide opportunities for the Outcome to be fulfilled by means of sampling across the range of the content of Outcome 1. Each sample must include the following:

- Properties of sound waves in air: amplitude, sound pressure level and frequency.
- Aspects of human hearing: perceptible frequency and loudness ranges, and health and safety limits.
- Role and operation of common transducers used in an audio system, namely microphones, loudspeakers, headphones, pickups and meters.
- Analogue audio signals: signal levels, impedance, unbalanced and balanced transmission.
- Digital audio signals: sampling rate and resolution and their impact on frequency response and signal to noise ratio.

The evidence for this Outcome must be obtained under supervised controlled conditions. The assessment will be open-book and last no more than 60 minutes. Learners may refer to notes, text books or other appropriate materials.

For Outcomes 2 and 3, performance evidence, supplemented with Assessor Observation Checklists, is required to demonstrate that the learner can successfully and safely assemble and test one stereo Sound Reinforcement system and one stereo recording system.

The Sound Reinforcement system should comprise of at least:

- two microphones
- two line level sources
- one DI (Direct Injection)
- one mixing console
- one power amp plus stereo speakers (or powered speakers if appropriate)

The stereo recording system should comprise of at least:

- two microphones
- two line level sources
- one DI
- one mixing console
- one recording device
- headphones for monitoring

The evidence for Outcomes 2 and 3 can be produced at appropriate points during the Unit under supervised conditions, but the assessor must authenticate that the evidence produced is the learner's own work. The assessor must ensure that learners adopt safe working practices throughout this Unit.

In Outcome 3 learners will be required to carry out a visual inspection of a system to identify and remedy at least two simple faults.

National Unit Support Notes

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Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit is aligned to the following Skillset National Occupational Standards (NOS):

- **CCSMT6**: Identify, test and use basic professional audio equipment connections and interfaces.
- **CCSMT8**: Use essential analogue and digital sound recording skills.

This Unit is designed to introduce learners to the journey that sound travels from a performer, through an audio system, to a listener. Learners will have an opportunity to examine sound at each stage of the signal path, namely as it exists as acoustic energy, is then converted into electrical form (both digital and analogue) and then back to acoustic form. In addition, learners will consider some basic aspects of human hearing including audible frequency and sound pressure level ranges and the health and safety implications of sound on the listener.

Learners will be given the opportunity to learn about basic properties of sound waves and their journey through analogue and digital systems and will have the opportunity to put theory into practice and acquire practical skills in connecting and testing typical small scale audio systems, taking into account any health and safety issues.

Outcome 1 introduces the basic concepts that apply to sound as it flows as acoustic energy, is converted into electrical energy, and then ultimately converted back to acoustic energy. The concepts can only be covered briefly at this level. More in-depth coverage can be expected in higher level Units. Further context for the concepts listed in the Evidence Requirements is given below:

- Properties of sound waves in air: amplitude, sound pressure level and frequency.

This should extend to the sound pressure levels and frequency content of sources in relation to the human hearing system and capture and reproduction of sound by transducers.

- Aspects of human hearing: perceptible frequency and loudness ranges, and health and safety limits.

National Unit Support Notes (cont)

Unit title: Sound: Understanding the Signal Path

This section should address the limitations of human hearing, for example audible frequency range and effects of excessive or prolonged exposure to noise. It is therefore expected to raise awareness of the importance of health and safety regulation on the protection of personnel working in the audio industry.

- Role and operation of common transducers used in an audio system, namely microphones, loudspeakers, headphones, pickups and meters.

This section provides an opportunity to explore common microphone pick up patterns, microphone types such as dynamic and condenser. Operation of headphone and loudspeaker transducers, guitar pickups and common metering such as digital peak meters and VU should also be considered.

- Analogue audio signals: signal levels, impedance, unbalanced and balanced transmission.

This section provides an opportunity to look at typical mic, line and speaker signal levels. The effect of impedance particularly in relation to D.I boxes and loudspeakers should be discussed. The use of both balanced and unbalanced transmission should be explored.

- Digital audio signals: sampling rate and resolution and their impact on frequency response and signal to noise ratio.

It is expected that the coverage of digital audio signals extends to the impact that sampling rate and resolution have on the resultant audio quality, particularly in relation to frequency response and signal to noise ratio.

In Outcome 2 the learner must be able to select appropriate cables for each system and connect each system correctly, taking into account any health and safety issues. Possible health and safety issues include:

- lifting of equipment
- positioning of equipment
- positioning of cables
- access to suitable mains supplies
- stability of stands

In Outcome 3 the learner must demonstrate an ability to test an assembled system safely, taking into account any health and safety issues. Possible health and safety issues could include:

- faulty cables
- physical defects with equipment
- incorrect connections
- incomplete connections
- inappropriate sound levels

National Unit Support Notes (cont)

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Guidance on approaches to delivery of this Unit

It is recommended that Outcome 1 is delivered in conjunction with the other Outcomes, as the knowledge contained in Outcome 1 is relevant to the successful completion of the tasks in Outcomes 2 and 3.

The content of Outcome 1 could be demonstrated with practical exercises using the audio systems that are set up as part of Outcome 2 on an on-going basis. It is recommended that the theoretical concepts of Outcome 1 are clearly demonstrated where possible, for example electrical signals could be demonstrated using an oscilloscope, and acoustic signals measured using a sound meter or spectrum analyser. In addition, equipment specification sheets and/or audio glossaries, which are readily available on the internet, could be used to clarify aspects of the operation of audio equipment such as polar patterns, frequency response, impedance, etc.

Outcomes 2 and 3 could be carried out in groups with each team member given a specific task to perform at each stage. The learner could therefore prove their competence over an extended time and gain the opportunity for Core Skills development.

Health and safety should be integral to teaching and learning, and centres should view this holistically in any practical exercises. Learners should be made aware that health and safety is the concern of all professionals and should adhere to current legislation.

If Outcomes 2 and 3 are integrated and carried out in groups, it could be that a learner may be asked to test an audio system that they have not assembled. In this case it could be that any of the health and safety issues mentioned above in relation to Outcome 2 could emerge as an issue in the scope of Outcome 3.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

A suitable assessment for Outcome 1 would be a multiple-choice test carried out under controlled conditions.

It would be preferable to carry out the assessment for Outcome 1 towards the end of the delivery of the Unit as the practical experience gained in Outcomes 2 and 3 will reinforce the required knowledge and skills.

A suitable method of assessment for Outcomes 2 and 3 would be practical exercises where learners are provided with a brief. The brief could outline the equipment required and how it should be connected (preferably in diagrammatical form).

National Unit Support Notes (cont)

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Outcome 2 should be assessed by the production of performance evidence, based on the requirements of the given brief. The brief should clearly state the equipment required and in what way the systems should be connected. If learners are working in groups, the role of each member of the group must be made very clear to ensure that over an extended period of time all learners demonstrate evidence of achieving all Performance Criteria.

It is expected that the systems connected as part of the requirements for completion of Outcome 2 will be used by learners as the basis for achievement of Outcome 3. However, as a small number of basic faults must be remedied by the learner in Outcome 3, assessors will have to ensure faults exist in the systems in order to allow learners an opportunity to achieve all the Performance Criteria.

For Outcome 3 the given system should have at least two simple faults for the learner to detect and remedy. Faults can include:

- incorrect connection
- visibly faulty connection
- incomplete connection

Assessor observation checklists should be kept for each learner to record performance evidence generated in Outcome 2 and 3.

Time should be allowed for any necessary reassessment.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at **www.sqa.org.uk/e-assessment**.

Opportunities for developing Core and other essential skills

Learners will be producing written and oral communication evidence as part of the assessment for Outcome 1. This offers ideal opportunities to develop aspects of the Core Skill of *Communication*.

In addition, if Outcome 2 involves the use of groups to assemble audio systems, then there will be scope for learners to further develop the Core Skills of *Communication* and *Working with Others*.

Outcome 3 provides opportunities for learners to develop *Problem Solving* skills, in tackling any faults that may develop in an audio system once it has been assembled.

History of changes to Unit

Version	Description of change	Date

General information for learners

Unit title: Sound: Understanding the Signal Path

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit is designed to introduce you to the route that sound travels from a performer, through an audio system, to a listener. You will examine how sound is converted from acoustic energy to electrical form and how it is converted back to acoustic energy. In addition, you will examine some basic aspects of human hearing including audible frequency and sound pressure level ranges and the health and safety implications of sound on the listener.

You will be given the opportunity to learn about basic properties of sound waves and their journey through analogue and digital systems. You will then have the opportunity to put theory into practice and acquire practical skills in connecting and testing typical small scale audio systems taking into account any health and safety issues.

Outcome 1 introduces basic concepts that apply to sound as it flows as acoustic energy, is converted into electrical energy, and then is converted back to acoustic energy.

In Outcome 2, you will select appropriate cables for two small audio systems and connect each system correctly, taking into account any health and safety issues.

In Outcome 3, you will demonstrate your ability to test an assembled audio system safely, taking into account any health and safety issues.

Outcome 1 will be assessed with a written or oral assessment.

Outcomes 2 and 3 will be assessed through practical demonstrations of your knowledge and skills.

You will have the opportunity to develop aspects of the Core Skills of: *Problem Solving*, *Communication* and *Working with Others*.