

As discussed at the last PLG, to provide guidance on vocational skills training from higher/ further education colleges we have been asked to define the core skills industry would like to find in technicians and production level operators. The following draft represents typical skills requirements of clean, hi- tech manufacturers as typified by requirements of photonics, optoelectronics, and electronics and advanced materials manufacturers. Skills are grouped into topics with the potential to map these onto HNC / HND modules.

This is a working draft for consultation to feedback the relevance of different skills sets. Please indicated the importance of the listed skills to you organisation with the following scale

**3- Vital to your business**

**2- Useful and relevant to some roles in your business**

**1- Generic useful skill, but only superficial relevant to your business**

**0 - Irrelevant**

In completing, note this will primarily be used to inform vocational training (e.g HNC /HND) provided by local further education colleges not degree level university training. Such training is modular with a different number of modules required as different levels for specific qualifications. When available there is also normally an opportunity for employers to send staff for training on specific modules. Not all skills will be relevant to all companies and some sector specific skills are identified. If there are additional skill sets that you believe would be relevant to multiple organisation please indicate.

We would also be grateful if you could provide a very short description of the typical working environment for employees with this approximate skill level in you organisation.

Please return by email to [John.lincoln@harlinltd.co.uk](mailto:John.lincoln@harlinltd.co.uk). All responses will be treated in confidence. Once aggregated the objective is to provide guidance on the most popular skills sets to further education colleges across country to reinforce interest in training in these areas. Please feel free to forward to your HR, or operational management or other organisations to whom you feel this is relevant. A pdf version of this can be downloaded at \_\_\_\_\_ if the formatting has not come through on email.

Top level grouping	Skill sets	Relevance
<b>General</b>	Familiarity with clean manufacturing environment. Basic understanding of manufacturing configuration- cell, batch and continuous flow etc	
	Familiarity with operating to clean room/ clean area protocols and procedures. Use appropriate personal and environmental protective equipment, eg. Safety classes clean room attire.	
	Familiarity with interfacing with manufacturing control systems – logging parts/ systems and Q/C and performance data at multiple points in manufacturing flow.	
	Know key characteristics features of different light sources, detectors and electrical components e.g laser LED, photodetectors, CCDs, resistance optical / electrical power etc	
	Ensure laser and eye safety - Awareness and compliance with laser and eye safety protocols including matching appropriate safety eyewear to source	
<b>Optoelectronic Assembly</b>	Handling and cleaning of optical components in accordance to specification, including coated optics. Visually inspect optics for damage. Awareness of damage mechanisms e.g scratch/dig, contamination. Handling of cleaning chemicals	
	Handling of electrical components in accordance to specification and ESD requirements, including optoelectronic components	

	Assemble components/modules according to specification. Including electrical, free space optics & fibre components, detectors & emitters (laser LED), and PCBs at board and system level	
	Identify handle and correctly install and remove electrical IC's and other electrical components. Perform and identify quality and reliable soldering joints for surface mount and through hole electronics	
	Align laser / optical delivery systems/beams in compliance with eye safety regulations, e.g. microscopes.	
	Read and interpret digital and analogue circuit diagrams. Read and interpret optical, laser light source and detector specifications and data sheets	
<b>Optical fibre specific</b>	Handle optical fibre within mechanical tolerance, including coated, jacket and bare fibre. Stripping and removal of fibre coatings, safe handling of fibre waste.	
	Join connectorised optical fibres. Visually inspect and clean optical fibre connectors. Identify connector types. Use fibre optic fault finder	
	Cleave optical fibre at correct length. Terminate fibre with appropriate fibre-optic connector. Use fusion splicer to join optical fibres	
<b>Lighting</b>	Understand characterisation and differences between LED light sources - angle of illumination, luminance, colour, thermal load, power consumption.	
	Handling and installation of LED light sources	
	Measure performance of LED lights, e.g luminance, in accordance with industry standards	
<b>Test &amp; measurement</b>	Operate test equipment to measure optical performance and compare to specifications e.g, power, wavelength, noise and beam characteristics. Spectrometer, power meter, oscilloscopes?	
	Operate electrical test equipment to measure AC/DC voltage, current and noise on active circuit boards (up to 240V ? higher)	
	Maintain calibrated test equipment	
	Measure temporal laser and light systems parameters (e.g pulse duration, repetition rate), selection of appropriate detector, practical impedance matching, use of oscilloscopes.	
	Understand basic principles of statistical process control, how to measure devices in SPC protocol,	
<b>System use / other</b>	Operate and trouble shoot basic solid state lasers	
	Perform laser marking, cutting or welding in accordance with specification. Awareness of key materials processing quality parameters	
	Operate and maintain cooling systems, e.g closed loop water cooling	
	Operate and maintain vacuum systems ? and gas handling systems	
<b>other</b>	<i>Please add any trainable skill sets that are missing and of widespread relevance</i>	

### Typical working environment

Please provide a short 1-2 sentence description of your typical manufacturing working environment or a non-confidential picture of the same. E.g shift based cell structured assembly at ESD benches under laminar flow clean hoods with partial clean room style, protective clothing procedures (coats).

This will be used to recommend the structure of practical training facilities so they more closely resemble typical hi-tech working environments.

Draft prepared by John Lincoln on behalf of EPSRC Centre for Innovative Manufacturing in Photonics and the Photonics Leadership Group, inspired by The National Photonics Skill Standards for Technicians 3<sup>rd</sup> edition prepared by OP-TEC: The National Center for Optics and Photonics Education, USA.