**MANUFACTURING AND ENGINEERING TECHNOLOGY**

製造與工程技術

# Robot Systems Integration

# 機器人系統整合

# Technical Description

技術說明書

worldskills

WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders, and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

國際技能競賽組織經競賽委員會決議並依組織章程、議事規則和競賽規則規定，已針對該職類之國際技能競賽採用以下最低規範。

The Technical Description consists of the following:

技術說明書中包括以下內容：

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# 1 Introduction 職類介紹

## 1.1 Name and description of the skill competition 職類名稱與說明

### 1.1.1 The name of the skill competition is 本職類的名稱為

Robot Systems Integration 機器人系統整合

### 1.1.2 Description of the associated work role(s) or occupation(s). 相關工作角色或職業之說明。

Within the last decade the number of robots installed in the world has increased dramatically. Each year approximately 400,000 robots are installed worldwide, a rate which is steadily increasing (source: IFR: International Federation of Robotics). This requires both the capacity to manufacture these robots, and the skilled human resources to install them.

近 10 年內，全球機器人安裝數量遽增，每年大約有 400,000 台機器人在世界各地進行安裝，其安裝率逐漸穩定成長中（消息來源：IFR 國際機器人聯盟），而這需要具備製造這些機器人的能力以及安裝機器人的專業技術人力。

To be useful, the robot needs to be integrated within an overall process that will benefit from its availability. According to the robot application: pick and place, load and unload, palletization, welding, and so on, the role of the robot integrator is to think about and decide: what is the most appropriate type of robot to use; how to organize the parts flow; how best to program the robot; how to make the robot cell safe, etcetera. These are considerations for the robot manufacturer, the system integrator, and sometimes the end user.

若要具有實用性，機器人需要在整個程序中進行整合，才能從其可用性中受惠，根據機器人應用：取放、裝載和卸載、疊棧、焊接等等，機器人整合工程師的角色需要思考與決定：最適合使用的機器人類型是什麼、如何組織安排零件流、如何以最佳方式編寫機器人程式、如何建立安全的機器人系統（Robot Cell）等等，這些都是機器人製造商、系統整合工程師需要考慮的要素，有時，終端使用者也不例外。

The robot system integrator must provide technical solutions to the robotization of all or part of a system by

機器人系統整合工程師必須提供所有或部分系統自動化的技術解決方案，經由

- incorporating a multi-articulating arm, together with the associated handling tools or special processes (such as handling, machining, painting, and welding), to increase competitiveness and

- 合併多節機器手臂和相關的搬運工具或特殊程序（如搬運、加工、噴漆及焊接），以提升競爭力並
- supporting the ergonomics, health and safety of the users and people around them.
- 支持人體工學、使用者和周遭人員的健康與安全。

Through additional devices the robot can acquire several "senses", such as sight and touch, in order to perform complex and precise tasks.

為執行複雜和精確任務，機器人可透過額外裝置獲得數種「知覺」，如視覺和觸覺。

The robot system integrator must be aware of technological developments in the manufacturing process, control systems, multi-articulated arm, and the evolution of regulations for robotization. Preliminary study, implementation, electrical connection for power and other automated systems, integration of peripheral equipment, and programming, as well as documentation, maintenance, and troubleshooting, are all essential tasks.

機器人系統整合工程師必須清楚瞭解製造過程、控制系統、多節機器手臂的技術發展及自動化規則的進展，動力和其他自動系統的初步研究、實行、電力連接、周邊設備的整合、程式編寫，以及文件處理、維護和除錯等等都是必要的基本任務。

Across the globe, small and medium-sized enterprises (SMEs) outnumber large corporations. Collectively, they employ more people. SMEs represent the majority of businesses that have yet to realize the advantages of automation and robotics, as the big companies like the automobile industry have already done. SMEs can automate by investing in "custom" or "hard" automation, where the automation is designed and built for a specific purpose, or in flexible robot systems. Robot automation offers advantages of increased flexibility for meeting changing production requirements typically found in SMEs as well as lower investment through the use of standard industrial robots.

全球的中小企業（SME）的數量超過大型企業，他們的共同點是僱用更多的人，中小企業代表著絕大多數的企業，他們都尚未瞭解到自動化和機器人學的優勢，因為像汽車工業這類的大型公司已經做到了，中小企業可透過投資專為特殊用途設計和建立，或用於靈活機器人系統的「客製」或「硬式」自動化達到自動化目的，機器人自動化帶來增進靈活度的優勢，符合常見於中小企業中日新月異的生產需求，以及透過標準工業機器人的使用降低投資成本。

All in all, robot system integration represents a new, growing, and universal opportunity for skilled and committed technicians.

從各方面來說，機器人系統整合工程師對技術純熟且盡心盡責的技術人員而言，代表著一個前景看好的全新普世機會。

### 1.1.3 Number of Competitors per team 該職類的參賽選手人數

Robot Systems Integration is a team skill with two Competitors per team.

機器人系統整合是一項團體競賽，每隊由 2 位具備專業技能的選手組成。

### 1.1.4 Age limit of Competitors 參賽選手的年齡限制

The Competitors must not be older than 25 years in the year of the Competition.

參賽時，選手年齡不得超過 25 歲。

## 1.2 The relevance and significance of this document
## 本文件的相關性與重要性

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods and procedures that govern the competition.

本文件包含本項技能競賽的標準以及競賽管理之評分原則、方法和程序。

Every Expert and Competitor must know and understand this Technical Description.

每位裁判和選手都必須熟悉並瞭解本技術說明書。

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

若因技術說明書所使用的語言不同而導致衝突，請以英文版本為準。

## 1.3 Associated documents 相關文件

Since this Technical Description contains only skill-specific information it must be used in association with the following:

於本技術說明書內容僅涵蓋特定職類之資訊，因此必須與以下文件併用：

- WSI – Code of Ethics and Conduct 倫理規範與行為守則
- WSI – Competition Rules 競賽規則
- WSI – WorldSkills Occupational Standards framework 國際職業標準架構
- WSI – WorldSkills Assessment Strategy 評量策略
- WSI online resources as indicated in this document 線上資源（如本文件所示）
- WorldSkills Health, Safety, and Environment Policy and Regulations. 健康安全與環境政策與規章

# 2 The WorldSkills Occupational Standards (WSOS) 國際職業標準

## 2.1 General notes on the WSOS 一般注意事項

The WSOS specifies the knowledge, understanding, and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

WSOS 詳細闡述在技術及職業表現上，支持國際最佳實務所需具備之知識、理解力和特定技能，WSOS 應反映代表產業與企業相關工作角色或職業的全球共識（www.worldskills.org/WSSS）。

The skill competition is intended to reflect international best practice as described by the WSOS, and to the extent that it is able to. The Standard is therefore a guide to the required training and preparation for the skill competition.

技能競賽旨在盡其所能地反映出 WSOS 所描述的國際最佳實務，因此，該標準是針對技能競賽的必要訓練與準備作業之指南。

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

在技能競賽中，對知識與理解力的評分係透過評量表現來實現，僅在出現不可抗力原因時，才會進行單獨的知識與理解力測驗。

The Standard is divided into distinct sections with headings and reference numbers added.

該標準可分為多個加入編號和標題的明確項目。

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the "weighting". The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

每個項目所分配的總分百分比，代表該項目在標準中的相對重要性，這通常被稱為「權重」，所有的百分比的總和為 100。權重決定評分方案中的分數配比。

Through the Test Project, the Marking Scheme will assess only those skills that are set out in the Standards Specification. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

評分方案將透過試題僅針對標準規範所列之技能進行評量，並在技能競賽的限制範圍內，盡可能全面地反映標準之內容。

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, provided that this does not distort the weightings assigned by the Standards.

評分方案會在實際可行的最大範圍內遵循標準之配分，只要不歪曲標準所訂定之權重，即可容許最多百分之五的變動。

## 2.2 WorldSkills Occupational Standards 國際職業標準

| Section | 項目 | | 相對重要性(%) | Relative importance (%) |
|---|---|---|---|---|
| 1 | **Work organization and management** | 工作組織及管理 | | 5 |

The individual needs to know and understand 每位選手必須熟悉和瞭解

- principles and methods of safe work execution

- 實行工作安全的原則和方法
- the purposes, uses, care and maintenance of all equipment together with their safety implications
- 所有設備的目的、使用、保護和維修，以及其安全含意
- environmental and safety principles and applications with regard to good housekeeping in the work area
- 關於維護整潔工作區域的環境與安全之原則和應用
- principles of effective communication
- 有效溝通的原則
- principles of effective collaboration
- 有效合作的原則
- the scope and limits of one's own and others' roles, responsibilities, and duties, both individually and collectively
- 個人與他人角色的範圍和限制，個人與全體的責任和義務
- parameters within which activities must be planned
- 活動中必須設計的參數
- principles and techniques for time management.
- 時間管理的原則和技巧

The individual shall be able to 每位選手必須能夠

- prepare and maintain a safe, tidy, and efficient work area

- 準備和維護安全、整潔且效率高的工作區域
- prepare self for the tasks in hand, including full regard to health, safety, and environment
- 為手邊的任務工作做好準備，包括充分顧及健康、安全與環境
- schedule work to maximize efficiency and minimize disruption
- 安排工作時間以發揮最大工作效率，同時將中斷狀況降至最低
- select and use all equipment and materials safely and in compliance with manufacturers' instructions
- 挑選並安全使用所有設備和材料，遵照製造商的操作指南。
- apply or exceed the health and safety standards applying to the environment, equipment, and materials
- 應用或超越適用環境、設備和材料的健康與安全標準
- restore the work area to an appropriate state and condition
- 將工作區域恢復至適當的狀態和環境
- contribute to team performance both broadly and specifically
- 為團隊表現做出大量且具體的貢獻
- give and take feedback and support.
- 給予並接受意見和支援

| 2 | **Communication and interpersonal skills** 溝通與人際關係技巧 | | 5 |
|---|---|---|---|

The individual needs to know and understand: 每位選手必須熟悉和瞭解：

- organizational cultures and behaviours within business and  industry

- 企業和行業內的組織文化和行為
- the purposes and range of required documentation in paper and electronic forms
- 規定的紙本文件和電子檔表格之目的和範圍
- the technical language associated with the occupation and sector
- 與職業和行業相關的技術語言
- the standards required for routine and exception reporting in oral, written, and electronic form
- 口頭、書面及電子檔形式的例行和異常報告之規定標準
- good practice in communication with clients, team members, and others
- 與顧客、團隊成員和其他人溝通的優秀實踐
- the purposes and techniques for generating, maintaining, and presenting records for one's own and others' uses.
- 製作、維護並提交自己和他人紀錄之目的和技巧

| Section | Relative importance (%) |
|---|---|

The individual shall be able to: 每位選手必須能夠：

- interact with a range of business and industry, modelling professional conduct at all times
- 與各種企業和行業互動，隨時塑造職業行為
- communicate by oral, written, and electronic means to ensure clarity, effectiveness, and efficiency
- 透過口頭、書面及電子形式進行溝通，意思是確保溝通的清晰度、有效性和高效率
- use a standard range of communication technologies
- 使用標準的溝通技術範圍
- discuss complex technical principles and applications with others
- 和他人討論複雜技術的原則及應用
- use active listening and questioning techniques
- 使用積極的傾聽和提問技巧
- read, interpret, and extract technical data and instructions from documentation in any available format
- 閱讀、說明並設法從任何可用格式的文件中取得技術資料和操作說明
- complete reports and respond to issues and questions arising
- 完成報告並回應出現的爭議與問題
- respond to clients' and personnel's needs face to face and indirectly
- 面對面直接回應顧客與員工的需求
- gather information and prepare documentation as required by the client and other individuals and groups.
- 收集資訊並準備顧客、其他個體和團體要求的文件

| 3 | Layout and design 配置與設計 | 15 |
|---|---|---|

The individual needs to know and understand: 每位選手必須熟悉和瞭解：

- the principles and relevant applications of computing and electronics
- 電腦學和電子學的原則和相關應用
- the relevant practical applications of engineering science and technology
- 工程科學和技術的相關實務應用
- the relevant practical implications of physical principles and interrelationships
- 物理原則和相互關係的相關實務含意
- the principles and relevant applications of electrical engineering and pneumatics
- 電機工程學和氣壓學的原則和相關應用
- the design, uses, repair and maintenance needs of relevant machinery and tools
- 相關機械和工具的設計、使用、修護和維修需求
- the principles and applications of robots, robotic tools and equipment mounted on robots and in robotic cells
- 機器人、安裝在機器人身上和機器人系統中的機器人工具和設備之原則和應用
- principles and methods of systems analysis to determine how conditions, operations and the environment will affect outcomes

- 系統分析的原則和方法，以確認條件、操作及環境如何影響結果
- principles and applications for incorporating and integrating robots within industrial systems, such as:
- 合併及整合機器人和工業系統的原則和應用，如：
- payload settings 裝載設定
- reach studies 可達距離之研究
- motion optimization 動作最佳化
- principles of CAD and offline simulation tools used for layout and design of robot systems
- CAD 和用於機器人系統的配置與設計離線模擬工具之原則

| Section | Relative importance (%) |
|---|---|

The individual shall be able to: 每位選手必須能夠：

- acquire and check instructions and guidance for given assignments

- 取得並檢查規定工作的操作說明和指南
- identify and resolve areas of uncertainty within the parameters of the  brief
- 識別並解決在簡要說明的參數範圍內之不確定區域
- carry out initial systems design for given industrial applications
- 針對規定的工業應用進行初始系統設計
- inspect installation sites or use alternative methods to test the applicability of initial systems  design
- 檢查安裝現場或使用替代方法測試初始系統設計的適用性
- optimize systems designs within the parameters of the given industrial applications
- 最佳化在規定的工業應用參數範圍內的系統設計
- incorporate the dimensioning of electrical and pneumatic  systems
- 合併電機和氣壓系統的尺寸標註
- determine the role of pneumatic engineering in the choice and connection of controls and  activators
- 確認氣壓工程在控制和催化劑的選擇及連結中之角色
- carry out systems analyses for risk assessment
- 進行風險評估的系統分析
- itemize the requirements and implications of installation and integration in relation to
- 詳細列舉與安裝及整合之設備和含意有關的
  - robots, ancillary equipment, and tools 機器人、輔助設備和工具
  - human resources and time 人力資源和時間
  - estimated impacts on production during  installation 安裝期間對產品的預期影響
  - estimated impacts on production following  installation 安裝後對產品的預期影響
  - operating parameters and risk  management 操作參數和風險管理
- present proposals for consideration and approval, and adjust as  required.
- 提交提案以供考慮和核准，並依需求進行調整。

| 4 | Installation and connectivity 安裝與連結 | 15 |
|---|---|---|

The individual needs to know and understand: 每位選手必須熟悉和瞭解：

- the norms and cultures of the receiving industrial sites

- 接收的工業用地之規範和文化
- principles and methods for the safe receipt and ongoing management of equipment, tools, and materials
- 設備、工具和材料的安全接收及持續管理之原則和方法
- principles underlying the physical installation of robotics into production systems
- 構成將機器人實體安裝到生產系統的基礎原則
- principles and methods for assembling pre-manufactured robots in their positions for use
- 在適當位置組裝預先製造的機器人以供使用之原則和方法
- principles and methods for assembling and fixing tools and equipment to the robots
- 將工具和設備組裝並固定在機器人身上的原則和方法

| Section | Relative importance (%) |
| --- | --- |
| • principles underlying the positioning, connection and use of electrical power<br>• 構成定位、連接及使用電力的基礎原則<br>• principles underlying the positioning, connection and use of pneumatics.<br>• 構成定位、連接及使用氣壓的基礎原則<br>• Principles underlying the correct foundations and fixing methods required for installation of industrial robots and peripheral equipment<br>• 構成安裝工業機器人和周邊設備所需的校正功能與固定方法之基礎原 | |

| Section | Relative importance (%) |
|---|---|

The individual shall be able to: 每位選手必須能夠：

- check that all items have been delivered according to specification, and follow up as required
- 根據規範，檢查所有已運送的項目並依需求進行後續追蹤
- organize the safe storage of all items, together with arrangements for their checking in and out
- 安排所有項目的安全存放處，同時登記並檢查
- check that the pre-manufactured robot has been delivered ready to run, and follow up as required
- 檢查已運送的預先製造機器人是否準備好運作並依需求進行後續追蹤
- connect robot system components according to instructions and documentation
- 根據操作說明和文件，連接機器人系統的零件
- assemble, position, and fix robotic tools and equipment according to instructions and documentation
- 根據操作說明和文件，組裝、定位及固定機器人工具和設備
- align, fit, or assemble components, using hand tools, power tools, fixtures, or templates, according to specification
- 根據規範，使用手工具、電動工具、夾具或模板校直、配合或組裝零件
- liaise with specialists for the correct electrical, pneumatic, and mechanical installation of robots and peripheral equipment
- 聯絡專業人員以校正機器人與周邊設備的電力、氣壓和機械安裝
- connect Input/Output (I/O) control signals between robot and peripheral equipment, either low voltage (24V) or Ethernet/Bus systems.
- 連接機器人和周邊設備之間的低電壓（24V）或乙太網路／匯流排系統之輸入／輸出（I/O）控制信號。
- perform tests during the installation process to ensure functionality
- 在安裝過程進行測試以確保功能性
- identify installation issues, consider alternative solutions, and implement selected solution(s) to resolve the issues
- 識別安裝問題，考慮替代解決方案並執行選擇的解決方案以解決問題
- respect and take account of the receiving sites' requirements and characteristics, within the bounds of safe working, active risk management, and professionalism.
- 在安全作業、積極的風險管理及專業精神的範圍內，尊重並將接收的場地之規定和特性列入考慮。

| 5 Automation and programming 自動化與程式設計 | 25 |
|---|---|

The individual needs to know and understand: 每位選手必須熟悉和瞭解：

- computer capabilities and symbolic logic
- 電腦功能和符號邏輯
- principles governing the purposes and functions of computer hardware and software
- 管理電腦硬體與軟體的目的和功能之原則
- principles and options for

- 原則和選項：
  - manipulating robot coordinate frames, for robot, cell, and tooling
  - 適用機器人、系統和工具製造的機器人座標架構之操作
  - controlling robot motion
  - 控制機器人動作
  - controlling robot input/output (I/O) functions
  - 控制機器人輸入／輸出（I/O）功能
  - optimizing the user interface and
  - 最佳化使用者介面及
  - enabling re-programming and adjustment
  - 能夠重新編寫程式和調整
- the principles, reasons or facts that provide the basis for breaking down information or data into separate parts
- 將資訊或數據分解成不同片段的基礎原則、原因或事實
- methods for obtaining information and data from all relevant sources
- 從所有相關來源中獲取資訊及數據的方法
- principles and methods for processing information and data
- 處理資訊及數據的原則和方法
- the software in use 使用中的軟體
- sensor integration. 感測器整合

  - simple digital/electrical sensors 簡單的數位／電力感測器
  - advanced sensors such as Vision or Force sensors 高階感測器，如視覺或壓力感測器

| Section | Relative importance (%) |
|---|---|

The individual shall be able to: 每位選手必須能夠：

- consult with client/personnel to clarify program intent=
- 顧客／員工商議以闡明程式設計的意圖
- develop diagrams or flow charts of systems operations
- 製作系統操作的圖表或流程圖
- write, analyse, review and rewrite programs, using flow charts and diagrams
- 使用流程圖和圖表編寫、分析、審查並重新編寫程式
- create application software programs that are easy to document, understand and maintain
- 建立方便記錄、瞭解和維護的應用軟體程式
- conduct trial runs of programs and software applications to ensure they will produce the desired robot and cell performance
- 進行程式和軟體應用程式試運轉，確保能製造出預期的機器人和系統效能
- write, update, and maintain computer programs or software packages to handle specific jobs
- 編寫、更新並維護電腦程式或套裝軟體以處理特殊工
- optimize robot motion performance and I/O handling to minimize cycle time/maximize throughput while retaining reliable operation
- 最佳化機器人的動作效能及輸入／輸出（I/O）處理，將循環時間縮至最短／將處理能力發揮到極致，同時保持可靠操作
- correct errors by making appropriate changes and rechecking the program to ensure that the desired results are produced
- 透過適當的更改和重新檢查程式來校正錯誤，確保產生預期結果
- consult with other personnel to identify problems and suggest changes
- 與其他員工商議以識別問題並提出更改建議。
- implement new additional software and hardware options based on standard functionality.
- 執行以標準功能為基礎的其他軟體和硬體新選項。
- Integrate simple and advanced sensors
- 整合簡單和高階感測器

| | | |
|---|---|---|
| 6 | Commissioning, maintenance, and troubleshooting 驗收、維護及除錯 | 25 |

The individual needs to know and understand: 每位選手必須熟悉和瞭解：

- the formal requirements for successful site acceptance tests
- 成功的現場驗收之正式規定
- the scope and limits of the technologies, methods operational environment
- 技術、方法操作環境的範圍及限制
- criteria and methods for testing equipment and systems
- 測試設備與系統的標準和方法
- strategies for fault finding, problem solving and optimization
- 偵錯、解決問題及最佳化的策略
- techniques and options for replacements and repairs
- 替換和修護的技術和選項
- principles and techniques for generating creative and innovative solutions
- 產生創意與創新解決方案的原則和技術

- principles and options for establishing and maintaining production maintenance regimes
- 建立與維持生產維護制度的技術和選項

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The individual shall be able to: 每位選手必須能夠：

- investigate whether the robot and its peripheral equipment are responding to the programs' instructions

- 調查機器人和其周邊設備是否能回應程式的指令
- revise, repair or expand existing programs to increase operational efficiency or adapt to new requirements
- 修改、修復或擴大現有程式，以提升高效操作或適應新規定
- repair or replace components as required
- 依需求修護或替換零件
- develop Human-Machine-Interface (HMI) applications for the users of the robot system, using HTML or other web technologies
- 使用 HTML 或其他網頁技術，為機器人系統的使用者開發人機介面（HMI）應用程式
- advise on maintenance regimes to maximize efficiency and minimize disruption.
- 提出與維護制度有關的建議，以發揮最大工作效率，同時將中斷狀況降至最低。

| 7 | Documentation, briefing, and reporting | 文件、簡要說明及報告 | 10 |
|---|---|---|---|

The individual needs to know and understand: 每位選手必須熟悉和瞭解：

- the role and importance of maintaining records of each stage of activity

- 維護每一個活動階段的紀錄之角色和重要性

- the required media and formats of records and reports to ensure compliance with contracts, regulations and legislation, verification, and audit

- 規定的紀錄和報告之媒體及格式，以確保遵照合約、規定與法規、驗證與稽查之規範

- the needs of users and specialists for information, guidance, and instructions in suitable forms (media, content, language, format, and presentation)

- 使用者和專業人員對適當形式（媒體、內容、語言、格式和呈現方式）的資訊、指南及操作說明之需求

- clients' specific information needs

- 顧客的特殊資訊需求

- basic principles and techniques for briefing and training non-specialist end users

- 簡要說明及訓練非專業人員的終端使用者之基本原則和技術

- principles and techniques for critical review of own and others' performance.

- 適用自己與他人表現的重要審查之原則和技術。

- principles of common PC/Office software

- 常見的 PC / Office 軟體之原則

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The individual shall be able to: 每位選手必須能夠：

- liaise with other personnel or departments for project integration

- 聯絡其他員工或部門以進行專案整合

- document design and development procedures according to requirements

- 根據規定，進行文件設計與製作程序

- compile and write documentation of program development and subsequent revisions, inserting comments in the coded instructions so that others can understand the computer programs

- 編譯與編寫程式開發和後續修訂版本的文件，在程式碼指令中插入註解，讓其他人得以瞭解電腦程式

- present and provide test results from the commissioning process

- 提出並提供驗收過程的測試結果

- design or contribute to instructions and guidance to guide end users, with an emphasis on clarity and ease of use

- 設計或為強調清楚及方便使用的操作說明和指南做出貢獻，以引導終端使用者

- provide the end user with a set of documentation in appropriate formats, including all necessary robot data such as:

- 提供終端使用者適當格式的文件組，包括所有需要的機器人資料，如：

  - operating instructions

  - 操作指令

- application specific fault messages - I/O Listings
- 應用程式的特殊錯誤訊息 - 輸入／輸出（I/O）清單
- user adjustable parameter (register) descriptions
- 使用者調整參數（暫存器）說明
- review each part of the process of design, fabrication and assembly, and operation, against established criteria, including accuracy, consistency, time, and cost
- 依照以建立的標準，審查每一段設計、製造與組裝及操作過程，包含準確度、一致性、時間和成本
- contribute to individual and collective quality and contract review, responding to questions and challenges appropriately.
- 為個人和集體品質與合約審查做出貢獻，適當地回應問題及挑戰。

| Total 總分 | 100 |
|---|---|

# 3 The Assessment Strategy and Specification
## 評量策略與說明書

## 3.1 General guidance 總則

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

評量由 WorldSkills 評量策略所管理，WorldSkills 評量和評分必須遵守該策略制定的原則與技巧。

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

裁判評量實踐是國際技能競賽的核心，因此，它也是持續專業發展和審查的主體，評量的專業知識增長代表著國際技能競賽所採用的主要評量工具之未來用途和方向：評分方案、試題和競賽資訊系統（CIS）。

Assessment at the WorldSkills Competition falls into two broad types: measurement and judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

國際技能競賽的評量分為兩大類：測量與判斷，針對這兩種評量類型，使用明確的基準來評估每個細項是品質保證的重要關鍵。

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

評分方案必須遵循標準中的權重，而作為技能競賽評量工具的試題，也須遵循標準，競賽資訊系統（CIS）不僅能及時準確地記錄分數，且具備持續擴充監督、支援和提供回饋等能力。

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, in order to demonstrate their quality and conformity with the Standards.

簡言之，評分方案將引導試題設計的過程，隨後，透過反覆過程設計、制定並驗證評分方案和試題，確保最佳化兩者與標準之間的關係，為證明評分方案和試題的品質及符合標準的要求，兩者取得裁判同意後將一同提交 WSI 核准。

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

在提交 WSI 核准前，請和 WSI 技能顧問密切討論評分方案和試題以確保其品質，並獲益於 CIS 功能的協助。

# 4 The Marking Scheme 評分方案

## 4.1 General guidance 總則

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

本節說明評分方案的角色和位置、裁判如何如透過試題以及評分程序和規定來評量選手展示的作品。

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

評分方案是國際技能競賽的關鍵工具，因為它將評量與代表各項技能競賽的標準聯繫在一起，而各項技能競賽本身即是一種全球性的職業。評分方案旨在依據標準中的權重，為每個細項表現分配分數。

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

評分方案藉由反映標準中的權重，為試題之設計設立參數。依技能性質及其評量需求之不同，較適合一開始就詳盡闡述評分方案，以作為設計試題的指南；或者也可以將評分方案的大綱作為試題初步設計的基礎，但在這之後，評分方案和試題應該同步發展。

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

前述第 2.1 項明確指出，若無可行的替代方案，評分方案和試題可能在某種程度上偏離標準所訂定之權重。

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more independent people with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance. Please see the Rules for further details.

秉持公正公平的原則，越來越多的評分方案和試題選擇由一位或多位具備相關專業的獨立人員共同設計與制定，在此情況下，裁判在競賽或該競賽模組開始前才能看到評分方案和試題，詳盡的最終版評分方案和試題若由裁判所設計，則在提交獨立單位確認並做出品質保證前，須獲得全體裁判評審團的核準，進一步的詳細內容，請參閱競賽規則。

Experts and Independent Assessors are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

裁判與獨立評分人員必須在完成評分方案和試題前，提交審查、驗證和確認，同時也希望在整個設計與制定過程中，他們能與自己的技能顧問、審查者和驗證者合作，以確保評分方案和試題的品質，並充分利用 CIS 的功能。

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the

Competition. Skill Advisors actively facilitate this process.

在所有情況下，評分方案初稿最慢必須在競賽前 8 週輸入 CIS，技能顧問須積極促進此流程。

## 4.2 Assessment Criteria 評分標準

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

評分方案的主標題即為評分標準，這些主標題比試題還早出現或來自相關聯的試題，某些職類的評分標準可能與標準中的章節標題相似，其他職類則可能不盡相同，評分標準通常有 5 到 9 項，無論標題是否相符，整體評分方案必須反映標準中的權重。

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). *The Assessment Criteria, the allocation of marks, and the assessment methods, should <u>not</u> be set out within this Technical Description. This is because the Criteria, allocation of marks, and assessment methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published.*

評分標準由制定評分方案者（1人或以上）所建立，他們可以自行定義最適合試題評量與評分的標準，每一項評分標準皆以英文字母（A-I）定義。評分標準、配分和評分方法不應該在本技術說明書中進行說明，這是因為評分標準、配分和評分方法均取決於評分方案和試題的種類，而評分方案和試題則於本技術說明書公布後才做出決定。

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

由 CIS 產生的評分總表將包含評分標準及次評分標準清單。

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

每項標準獲得的分數將由 CIS 計算，計算結果將成為該評分標準中每一細項的累計總分。

## 4.3 Sub Criteria 次評分標準

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by measurement or judgement, or both measurement and judgement.

每項評分標準可分為一個或多個次評分標準，每個次評分標準則為 WorldSkills 評分表的標題，每份評分表（次評分標準）包含經由測量或判斷方式評量和評分的細項，抑或是兩者兼具。

Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

每份評分表（次評分標準）上都詳細指明評分日期和評分小組的身分。

## 4.4 Aspects 評分細項

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by measurement or by judgement.

每一評分細項都詳細定義出待評量和評分的單項和該給予之分數，並作為給分指南詳細描述或說明之。評分細項一律採測量或判斷評分。

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

評分表上詳細列出每一個待評分的細項及配分。各評分細項獲得的分數總和必須落在標準中指定的分數範圍內。自競賽前 8 週（C-8）起，當評分方案通過審查後（請參閱本文第 4.1 項），

| | | CRITERIA | | | | | | | | TOTAL MARKS PER SECTION | WSSS MARKS PER SECTION | VARIANCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | | | |
| STANDARDS SPECIFICATION SECTION | 1 | 5.00 | | | | | | | | 5.00 | 5.00 | 0.00 |
| | 2 | | 2.00 | | | | | 7.50 | | 9.50 | 10.00 | 0.50 |
| | 3 | | | | | | | | 11.00 | 11.00 | 10.00 | 1.00 |
| | 4 | | | 5.00 | | | | | | 5.00 | 5.00 | 0.00 |
| | 5 | | | | 10.00 | 10.00 | 10.00 | | | 30.00 | 30.00 | 0.00 |
| | 6 | | 8.00 | 5.00 | | | | 2.50 | 9.00 | 24.50 | 25.00 | 0.50 |
| | 7 | | | 10.00 | | | | 5.00 | | 15.00 | 15.00 | 0.00 |
| TOTAL MARKS | | 5.00 | 10.00 | 20.00 | 10.00 | 10.00 | 10.00 | 15.00 | 20.00 | 100.00 | 100.00 | 2.00 |

分數就會顯示在 CIS 配分表中，如下圖格式所示。

## 4.5 Assessment and marking 評量與評分

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by judgement, measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams

must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

無論評量與評分採判斷、測量或兩者兼之的方式，每一個次要評分標準均由一個評分小組負責，同一個評分小組須對所有選手進行評量與評分。若此方式不可行（例如：某項動作必須所有選手在被監看的情況下同時進行），則可在取得競賽委員會管理小組核准後，制定第二層評量與評分。評分小組之組成必須確保在任何情況下均沒有同國評分之狀況。（請參閱第 4.6 項）

## 4.6 Assessment and marking using judgement 判斷評量與評分

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, judgement must be conducted using:

判斷評分採用 0-3 分制量表，為明確且一致的使用量表，必須依下列方式做出判斷：

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts or separate guidance notes)

- 每一個評分細項（以文字、圖像、人工製品或獨立指南說明所示）基準（標準）之詳細指南
- the 0-3 scale to indicate: 0-3 分制量表指出：
  - 0: performance below industry standard 表現低於業界標準
  - 1: performance meets industry standard 表現符合業界標準
  - 2: performance meets and, in specific respects, exceeds industry standard
  - 表現符合業界標準且在特定方面超越業界標準
  - 3: performance wholly exceeds industry standard and is judged as excellent
  - 整體表現超越業界標準且判斷為傑出

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

每一評分細項均由 3 位裁判負責判斷評分，通常會同時記錄下他們的分數。第 4 位裁判則負責調節和監督給分，確認分數的有效性，必要時，亦須擔任法官的角色，預防發生同國評分之情況。

## 4.7 Assessment and marking using measurement 測量評量與評分

Normally three Experts will be used to assess each aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

通常每一評分細項均由 3 位裁判負責，並由第 4 位裁判在旁監督，在某些情況下，評分小組可分為兩組（兩人一組），以進行雙重評分。除非另有說明，才能給予 0 分或最高分，當此情形適用時，給予部分分數之基準將明確定義在該評分細項中。為避免計算或傳送過程中出現錯誤，請務必使用 CIS 提供的多種自動計算選項。

## 4.8 The use of measurement and judgement 測量和判斷的使用方法

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

關於標準和評分方式的選擇，將於競賽設計期間透過評分方案和試題來決定。

## 4.9 Skill assessment strategy 技能評量策略

WorldSkills is committed to continuous improvement. This particularly applies to assessment. The SMT is expected to learn from past and alternative practice and build on the validity and quality of assessment and marking.

WorldSkills 致力於持續不斷的提升，這特別適用於評量方面，SMT期望能汲取過去的經驗，在有效和優質評量和評分的基礎上採用替代做法。

The Competition Information System (CIS) will perform the calculations required for the allocation of time points.

競賽資訊系統（CIS）將進行時間點分配所需之計算。

Competitors may not modify cell components in any way during the competition. Exceptions are announced by the Skill Management Team.

選手在競賽時間不得以任何方式修改系統零件，例外情況將由技能管理小組宣布。

The Sponsor support team provides spare and replacement parts to Competitors only during competition time. Exceptions are announced by the Skill Management Team.

贊助商支援小組僅在競賽期間為選手提供備用和更換零件，例外情況將由技能管理小組宣布。

## 4.10 Skill assessment procedures 技能評量程序

Assessment and marking are an intense process that depends upon skilful leadership, management, and scrutiny.

評量與評分是一個令人緊張的過程，需具備技能領導、管理和監督能力。

Assessment "best practices and procedures" are described in the Guidelines for Assessment for Robot System Integration.

評量「最佳實務和程序」說明於機器人系統整合的評量指南中。

Both Competitors being assessed have to be present during the entire assessment procedure.

在整個評量程序期間，接受評分的兩位選手必須在場。

# 5 The Test Project 試題

## 5.1 General notes 一般注意事項

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

試題的制定請見本文第 3 條和第 4 條，此處注意事項為補充說明。

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS.

無論試題是單一實體、一系列獨立或相關的模組，都能作為 WSOS 各項目中闡述的應用知識、技能和行為之評量。

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Standards will be a key indicator of quality, as will be its relationship with actual work performance.

試題的目的是在標準中，結合評分方案，提供完整、不偏不倚且可靠的評量與評分機會。試題、評分方案及標準之間的關係是品質的關鍵指標，如同三者與實作表現之間的關係。

The Test Project will not cover areas outside the Standards, or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

試題範圍既不涵蓋標準外的內容，亦不會影響標準內的分數平衡，本文第 2 條所指的情況除外。凡影響試題能否支持與標準有關的完整評量範圍之問題，本技術說明書都會註記，請參閱第 2.2 項。

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work. The Test Project will not assess knowledge of WorldSkills rules and regulations.

試題僅對知識和理解力在實作中的應用進行評量，而不會對 WorldSkills 規則與規範的知識進行評量。

Most Test Projects (and Marking Schemes) are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Developer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

大部分的試題（和評分方案）現在都由裁判們獨立設計與制定，通常從競賽前 12 週（C-12）起，開始由技能競賽經理或獨立命題人員進行設計和制定，且須經過獨立審查、驗證和確認。（請參閱第 4.1 項）

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

以下提供資訊將以本技術說明書完成時的內容與保密規定為準。

Please refer to the current version of the Competition Rules for further details.

請參閱現有的競賽規則版本以取得進一步的詳細資訊。

## 5.2 Format/structure of the Test Project 試題的格式／結構

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Completion of a Robot System Integration project, through all steps from planning through implementation to documentation will use a realistic Test Project based on the FANUC Education Cell.

使用以 FANUC Education Cell 為基礎的實際試題，透過規劃的實行到文件處理的所有步驟，完成機器人系統整合專案。

The Test Project is presented to the Competitors in the form of a project specification from an Industrial Customer.

試題將以出自業界顧客之手的專案規範形式發給選手。

## 5.3 Test Project design requirements 試題的設計規定

Overall, the Test Project must: 整份試題必須：

- Be modular, consisting of linked tasks to create a basic project and with additional tasks/modules which will result in an excellent project if completed during the Competition;

- 模組化，由相連的任務工作組成，旨在建立基礎專案，若能在競賽期間完成額外的任務工作／模組，將創造出卓越的專案；

- Be accompanied by a marking scale that is finalized at the Competition in accordance with section 3;

- 依據本文第 3 條，配套的評分量表須於競賽中完成；

- Be validated according to section 5.5;

- 依據本文第 5.5 項確認試題；

- The Test Project may include software or hardware functions which have not been disclosed to the Experts or Competitors in advance, to test the ability of Competitors to understand and use these under pressure.

- 試題可能涵蓋軟體或硬體功能且不會提前透露給裁判或選手，以便測試選手是否能在壓力之下，瞭解和使用這些軟體和硬體。

- Be supplied with documentation clarifying the operation of special or new robot hardware or software functions for the Experts and Competitors, as well as the standard robot reference manuals.

- 提供裁判和選手闡明操作特殊或新機器人硬體或軟體功能的文件，以及標準機器人參考手冊。

## 5.4 Test Project development 制定試題

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

試題務必以國際技能競賽組織提供的模板提交（www.worldskills.org/expertcentre），文字文件使用 Word 模板，圖稿使用 DWG 模板。

### 5.4.1 Who develops the Test Project or modules 試題或模組的制定者

The Test Project/modules are developed by an Independent Test Project designer/team, in collaboration with the Skill Competition Manager.

試題／模組將由獨立命題人員／團隊與技能競賽經理合作制定。

### 5.4.2 When is the Test Project developed 試題的制定時間

The Test Project/modules are developed according to the following timeline:

試題／模組根據下列時間表制定；

| Time 時間 | Activity 活動 |
|---|---|
| Six (6) months prior to the Competition 競賽前 6 個月 | Details of the latest version of the Global Partner Robot Equipment is circulated (not the actual Test Project). Global Partner Robot Equipment 將發布最新版本的細節（非真正的試題） |
| Three (3) months prior to the Competition 競賽前 3 個月 | The documentation for all software and hardware options used in the Test Projects is circulated. 將公布試題中所有使用到的軟體和硬體選項之文件 |

| At the Competition | If undisclosed software or hardware is included in the Test Project as part of the competition, the relevant documentation is supplied to Competitors to use during competition |
| --- | --- |
| 競賽期間 | 若試題涵蓋保密軟體或硬體作為競賽的一部分,則相關文件將於競賽期間提供給選手 |

## 5.5 Test Project initial review and verification

# 試題的最初審查與驗證

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations,

試題的目的是為選手創造挑戰，因為他們真正代表的是在已確認職業中出色從業人員的工作生活，透過此作法，試題將應用評分方案並完整體現 WSOS 精神，在其背景、目的、活動和期望中都是獨特的存在。

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer is expected to identify one or more independent, expert, and trusted individuals initially to review the Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

以恰當的嚴格品質保證和設計過程支持試題設計與制定（請參閱競賽規則第 10.6-10.7 項），WorldSkills 核准後，希望獨立命題人員能讓一位或多位獨立人員、裁判和可信賴者參與最初的命題者想法與計畫審查，然後在試題確認前進行驗證。

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

技能顧問將協調並確保此安排順利進行，並根據支持競賽規則第 10.7 項的風險分析，保證最初審查和驗證的適時性與完整性。

## 5.6 Test Project validation 確認試題

The Skill Competition Manager coordinates the validation and will ensure that the Test Project/modules can be completed within the material, equipment, knowledge, and time constraints of Competitors.

技能競賽經理須協調試題確認流程，確保試題／模組能在競賽材料、設備、知識和時間的限制下完成。

## 5.7 Test Project selection 挑選試題

The Test Project/modules are selected by the Independent Test Project Designer in collaboration with the Skill Competition Manager.

由獨立命題人員與技能競賽經理共同挑選試題／模組。

## 5.8 Test Project circulation 公布試題

If applicable, the Test Project is circulated via the website as follows:

The Test Project/modules are not circulated prior to the Competition.

如適用，試題可經由網站公布，如下：

試題／模組不會在競賽前公布。

## 5.9 Test Project coordination (preparation for Competition)

# 協調試題（為競賽作準備）

Coordination of the Test Project/modules is undertaken by the Skill Competition Manager.

協調試題／模組的工作由技能競賽經理負責。

## 5.10 Test Project change 更動試題

There is no 30% change required to be made to the Test Project/modules at the Competition. Exceptions are amendments to technical errors in the Test Project documents and to infrastructure limitations.

在競賽過程中，試題／模組無須進行 30% 的更動。

修正試題中的技術性錯誤及場地設備材料的限制為例外情況。

## 5.11 **Material or manufacturer specifications** 材料或製造商的規範

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These such items may include those for fault finding modules or modules not circulated.

讓選手得以完成試題的必要特定材料和／或製造商規範，將由競賽主辦單位提供，也可以從位於網站「裁判中心區」的 www.worldskills.org/infrastructure 取得。但請注意，在部分情況下，特定材料和／或製造商規範的詳細資訊可能處於保密狀態，不得於競賽前公布，這些項目包含故障排除或不公開的模組。

The Global Partner will supply all necessary documentation, manuals etc. in electronic form.

Global Partner 將以電子檔形式提供所有需要的文件、手冊等等。

Competitor PC Software and Internet Access

選手電腦的軟體和網路存取

- Competitors are provided with PCs for Simulation, Robot Setup, User Interface development etc.
- 選手會拿到作為模擬、機器人設定、使用者介面發展之用的電腦。
- All necessary software is pre-installed on these PCs, and it is forbidden to install any additional software
- 所有需要用到的軟體都已事先安裝在這些電腦中，禁止任何額外軟體的安裝
- These PCs are provided with an Ethernet cable to connect to the Robot Controller, and it is forbidden to make any additional connection via Ethernet or Wi-Fi. Internet access is forbidden.
- 這些電腦均提供作為連線機器人控制器用的乙太網路線，禁止透過乙太網路或 Wi-Fi 網路進行任何額外的連線。

Competitor PC Keyboard

選手電腦的鍵盤

- The Competitor PCs are equipped with US International standard Keyboards and basic mouse.

- 選手的電腦均配備美國國際標準鍵盤和基本的滑鼠。
- Competitors may bring their own keyboard and mouse to connect to the PC if they prefer
- 隨選手喜好，可自備用來連線電腦的鍵盤和滑鼠
- Hard-wired USB connections are recommended.
- 建議使用固線 USB 進行連線。
- The installation and functioning of these devices is the responsibility of the Competitors. It is permitted to install additional drivers if necessary, after approval by SMT.
- 這些裝置的安裝與功能由選手負責，若有需要，可在取得 SMT 核准後，於電腦中安裝額外的驅動程式。
- Neither WorldSkills nor the Global Partner or PC supplier can guarantee the compatibility or functioning of the Competitor supplied devices.
- 無論是 WorldSkills、Global Partner，或是電腦供應商均無法保證選手自備裝置的兼容性或功能。

# 6 Skill management and communication
# 技能管理與溝通

## 6.1 Discussion Forum 論壇

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the skill specific Discussion Forum (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be the moderator for this Forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

競賽之前，所有與技能競賽有關的討論、溝通、合作和決策，必須在該職類論壇
（http://forums.worldskills.org）內進行，唯有在論壇內被採用的技能相關決策和溝通才具有效力。論壇主持人為裁判長（或裁判長任命的裁判），有關溝通與競賽發展要求的時間表，請參閱競賽規則。

## 6.2 Competitor information 選手資訊

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

已登錄的選手可在網站中的「選手中心區」取得資訊（www.worldskills.org/competitorcentre）。

This information includes: 資訊包括：

- Competition Rules 競賽規則
- Technical Descriptions 技術說明書
- Mark Summary Form (where applicable) 評分總表（如適用）
- Test Projects (where applicable) 試題（如適用）
- Infrastructure List 場地設備材料清單
- WorldSkills Health, Safety, and Environment Policy and Regulations
- WorldSkills 健康安全與環境政策與規章
- Other Competition-related information 其他競賽相關資訊

## 6.3 Test Projects [and Marking Schemes] 試題〔和評分方案〕

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

已公告的試題請見 www.worldskills.org/testprojects 及「選手中心區」
（www.worldskills.org/competitorcentre）。

## 6.4 Day-to-day management 日常管理

The day-to-day management of the skill during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Skill Competition Manager. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalized at the Competition by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

競賽期間的技能日常管理定義於技能管理計畫內；該計畫係由技能競賽經理領導的技能管理小

組所建立，技能管理小組由技能競賽經理、裁判長和副裁判長組成，技能管理計畫於賽前 6 個月內逐步發展而成，並在競賽時經全體裁判同意後定案，技能管理計畫可見於「裁判中心區」（www.worldskills.org/expertcentre）。

## 6.5 General best practice procedures 一般最佳實務程序

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

一般最佳實務程序明確描述最佳實務程序的內容和技能之特殊規定（第 9 項）之間的差異，一般最佳實務程序是在裁判和選手無法對違反競賽規則或技能之特殊規定負責時，作為問題與爭議解決程序的一部分給予懲處，如倫理規範與行為守則懲處系統。在部分情況下，針對選手部分的一般最佳實務程序將反映在評分方案中。

| Topic/task 主題／工作任務 | Best practice procedure 最佳實務程序 |
|---|---|
| Competitor PC connectivity<br><br>選手電腦的連線能力 | • Competitor PCs are to be connected via Ethernet to the robot controller only.<br><br>• 選手的電腦僅能經由乙太網路連線機器人控制器。<br>• All other Ethernet or Wi-Fi connections are prohibited and should be disabled prior to the start of the competition.<br>• 所有其他的乙太網路或 Wi-Fi 網路連線一律禁止，並於賽前禁用。<br>• PC software must be able to run stand-alone, without needing access to Internet – for instance for licensing.<br>• 電腦的軟體必須能夠不存取網路獨立運行，例如取得授權。 |
| Competitor PC security<br><br>選手電腦的安全性 | • It must be ensured that neither the Competitors nor anyone else have access to the PCs outside of Competition hours.<br><br>• 須確保選手和其他人都不得於競賽時間外使用電腦。<br>• An example implementation of this is to store the Competitor PCs in the tool trolley with two locks. The key for one lock is held by the Competitors or their compatriot Expert. The key for the other lock is held by the SMT.<br>• 此作法的實施範例：使用兩個鎖將選手的電腦鎖在工具車中，一把鎖的鑰匙由選手或該國裁判保管，另一把鎖的鑰匙則由 SMT 保管。<br><br> |

| Robot Controller security | • It must be ensured that neither the Competitors nor anyone else have access to the Robot Controller outside of Competition hours. |
|---|---|
| 機器人控制器的安全性 | • 須確保選手和其他人都不得於競賽時間外使用機器人控制器。 |
| | • An example of this is to lock the Robot Controller in the power OFF position with the key secured in the same manner as the Competitor PCs. |
| | • 此作法的實施範例：使用鑰匙鎖住處於關機狀態的機器人控制器，與保管選手電腦安全的方法一樣。 |

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# 7 Skill-specific safety requirements 技能之特殊安全要求

Refer to WorldSkills Health, Safety, and Environment Policy and Regulations for Host country or region regulations.

請參閱主辦國或主辦地區的 WorldSkills 健康安全與環境政策與規章。

- It is not foreseen that the Test Project will include any electrical or mechanical assembly activities which require specific safety measures.

- 無法預測試題是否包含任何需要特殊安全措施的用電或機械組裝活動。
- Safe robot operating procedures must be followed. These must be reviewed with the Experts and Competitors at the start of the competition.
- 必須遵循安全機器人操作程序，這些必須由裁判和選手於競賽開始時一起檢查。
- The Experts are responsible for making sure that the Competitors follow the safe operating procedures.
- 裁判負責評分以確保選手遵循安全操作程序。
- The design of the Education Cell ensures that the robot can only be operated in Automatic (100% speed) mode when the robot cell door is closed.
- 請確保 Education Cell 的設計在機器人系統門關閉時，僅能在自動（100% 速度）模式下操作機器人。
- The robot must be operated only in T1 (reduced speed) mode when the robot cell door is open.
- 機器人在機器人系統門開啟時，必須僅能在 T1（降速）模式下操作。
- The use of T2 (100% speed with door open) mode is decided by the SMT for each competition.
- 由 SMT 針對每一項競賽決定是否使用 T2（100% 速度且門為開啟狀態）模式。
- The method of ensuring correct use of the Auto/T1/T2 key and other safety measures must be agreed with the SMT prior to the Competition, for instance:
- 確保正確使用自動／T1／T2 鑰匙和安全措施，須於競賽前徵 SMT 的同意，例如：

    - By indicating clearly by additional label on the robot controller.

    - 透過在機器人控制器上貼上額外標籤來明確指示。
    - By giving the Experts the Auto/T1/T2 key
    - 將自動／T1／T2 的鑰匙交給裁判

| Task | Safety glasses with side protection 側邊防護的護目鏡 | Sturdy shoes with closed toe and heel 堅固耐用的包頭鞋 | Hearing protection 聽力防護具 | Dust mask 防塵口罩 |
|---|---|---|---|---|

| | | | |
|---|---|---|---|
| General PPE for safe areas 安全區域的一般個人防護設備 | | √ | |
| General work at workstation 工作站內的一般工作 | | √ | |

ROBOT SYSTEMS INTEGRATION

# 8 Materials and equipment 材料與設備

## 8.1 Infrastructure List 場地設備材料清單

The Infrastructure List details all equipment, materials, and facilities provided by the Competition Organizer.

場地設備材料清單詳列競賽主辦單位提供的所有設備、材料和設施。

The Infrastructure List is available at [www.worldskills.org/infrastructure](www.worldskills.org/infrastructure).

場地設備材料清單請見 www.worldskills.org/infrastructure.。

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These such items may include those for fault finding modules or modules not circulated.

場地設備材料清單明定技能管理小組為下屆競賽所要求的品項和數量，競賽主辦單位將逐步更新清單，列明品項實際數量、種類、品牌和型號。請注意，在部分情況下，特定材料和／或製造商規範的詳細資訊可能處於保密狀態，不得於競賽前公布，這些項目包含故障排除或不公開的模組。

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions of any increases in space and/or equipment.

每次競賽時，技能管理小組必須檢視並更新場地設備材料清單，為下屆競賽做準備，如需增加任何空間和／或設備，請技能競賽經理務必告知技能競賽主任。

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

每次競賽時，技術觀察員務必稽查該競賽使用的場地設備材料清單。

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

場地設備材料清單不包括選手和／或裁判必須自備的品項，也不包括選手不得攜帶的品項－如下所列。

## 8.2 Competitors toolbox 選手的工具箱

Competitors are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

選手不得將工具箱寄送至競賽場，所有工具由競賽主辦單位提供。

## 8.3 Materials, equipment, and tools supplied by Competitors 選手自備的材料、設備和工具

It is not applicable for the Robot Systems Integration skill competition for Competitors to bring materials, equipment, and tools to the Competition. Exceptions are listed in section 5.11.

不適用機器人系統整合職類，因為該職類選手無須攜帶材料、設備和工具至競賽場。例外情況

列於第 5.11 項中。

However, Competitors are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

但選手必須自備個人防護設備，如第 7 項技能之特殊安全要求所述。

## 8.4 Materials, equipment, and tools supplied by Experts
## 裁判自備的材料、設備和工具

The Global Partner will supply all necessary equipment related to the Test Project for Experts.

Global Partner 將為裁判提供所有和試題有關的需求設備。

## 8.5 Materials and equipment prohibited in the skill area
## 職類區域內禁用的材料和設備

Use of any additional equipment is prohibited.

禁止使用所有額外的設備。

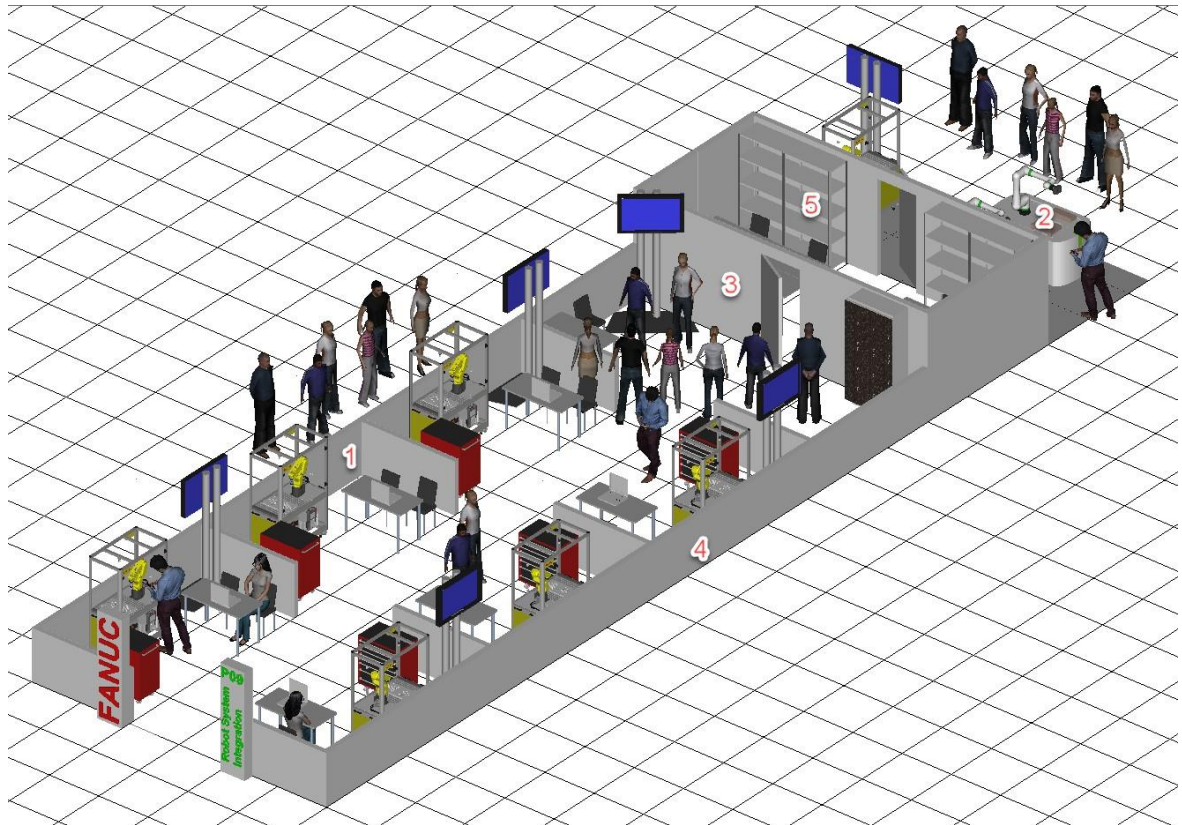## 8.6 Proposed workshop and workstation layouts

# 工作場地及工作站的平面圖提案

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

上屆競賽的工作場地平面圖請見 www.worldskills.org/sitelayout。

**Example workshop layout**

工作場地平面圖範例



Total area shown approximately 10 m x 23 m
上圖所示的總區域面積大約為 10 m x 23 m

1    Five complete sets of competition equipment as shown in section above.

5 組完整的競賽設備如上圖所示。
Each team has a space of approx. 4 m x 5 m to provide some separation between the teams.
每一組的空間大約為 4m x 5m，以在組和組之間提供一些間隔。

2    Public exhibition/engagement area where skill can be demonstrated to public and other interested parties

職類可以在公共展區／互動區域向民眾和其他感興趣的參觀團體進行展示

3    Experts area 裁判區

4    Booth is surrounded by low wall. Since each robot cell is self-contained and guarded, there is no need for special protection for spectators, so they can get close up to the competition cells. The cells have large transparent rear window allowing clear view for spectators.
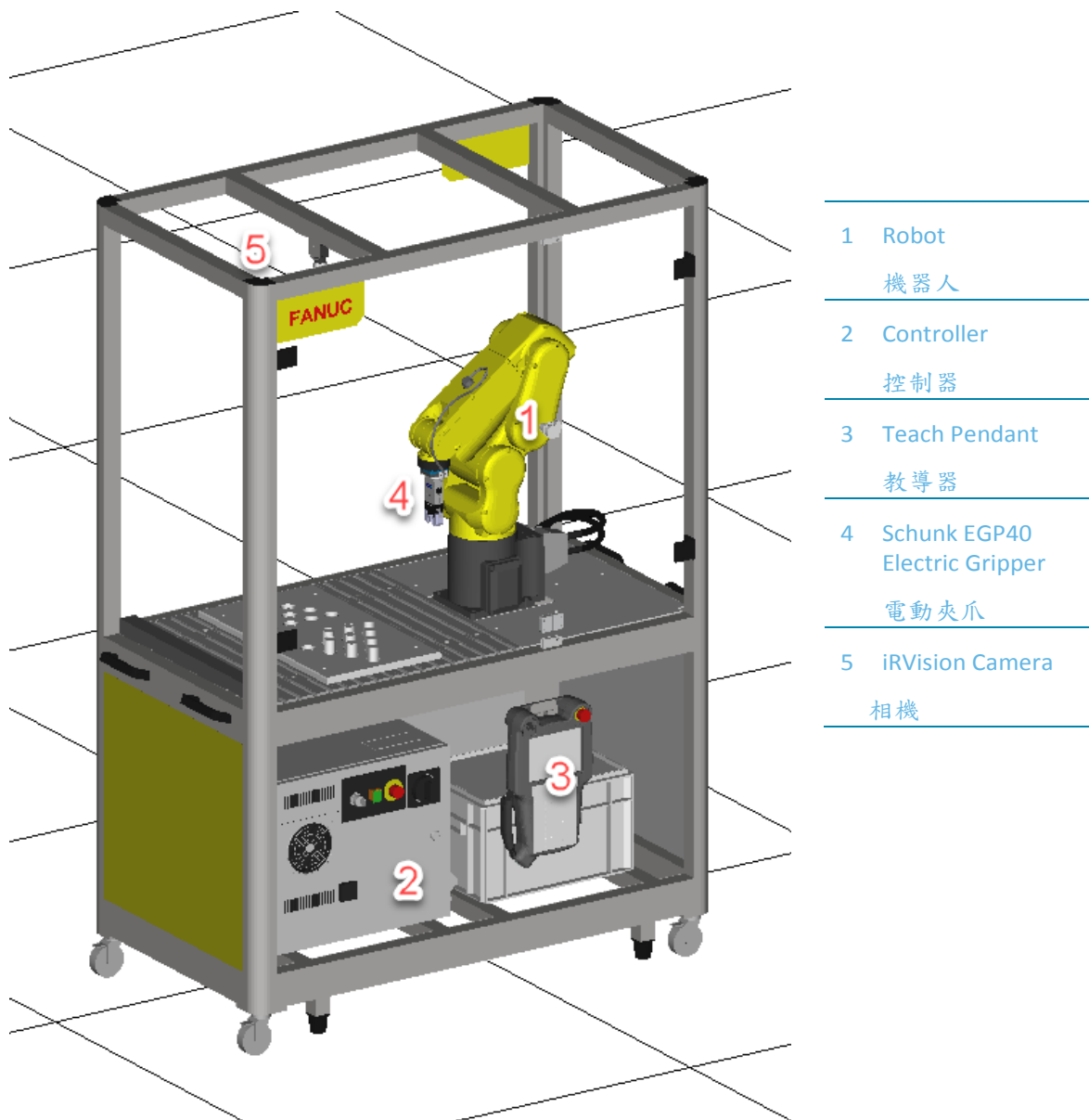
攤位以矮牆圍繞，因為每一個機器人系統皆為獨立且被看守著，所以無需為了觀眾而採取特別的保護措施，讓觀眾可以靠近競賽的機器人系統。這些機器人系統背面設有

5    Storage, Expert and Competitor Rooms, if required.

如有需要，設有儲藏空間、裁判和選手休息室。

## Standard FANUC Education Cell    標準 FANUC Education Cell



| | |
|---|---|
| 1 | Robot |
| | 機器人 |
| 2 | Controller |
| | 控制器 |
| 3 | Teach Pendant |
| | 教導器 |
| 4 | Schunk EGP40 Electric Gripper |
| | 電動夾爪 |
| 5 | iRVision Camera |
| | 相機 |

The cell uses the FANUC ER-4iA robot together with the latest generation R-30iB Mate Plus controller. The robot is equipped with integrated iRVision 2D camera system, and a Schunk EGP40 gripper.

該系統使用 FANUC ER-4iA 機器人和最新一代的 R-30iB Mate Plus 控制器,機器人配備經整合的 iRVision 2D 相機系統及 Schunk EGP40 夾爪。

The standard cell comes with full instructions and exercises which the Competitors can use to prepare themselves for the competition. The cell also comes with a running 'pick and place' application which is replaced for the competition.

標準系統提供完整的操作說明和練習,選手可作為競賽準備使用,該系統亦提供可運作的「取放」應用程式,競賽時將更換此應用(程式)。

**Additional Equipment 額外的設備**

In addition to the FANUC Education Cell, some additional equipment is needed as shown below.

除了 FANUC Education Cell 外，部分需求的額外設備如下圖所示。
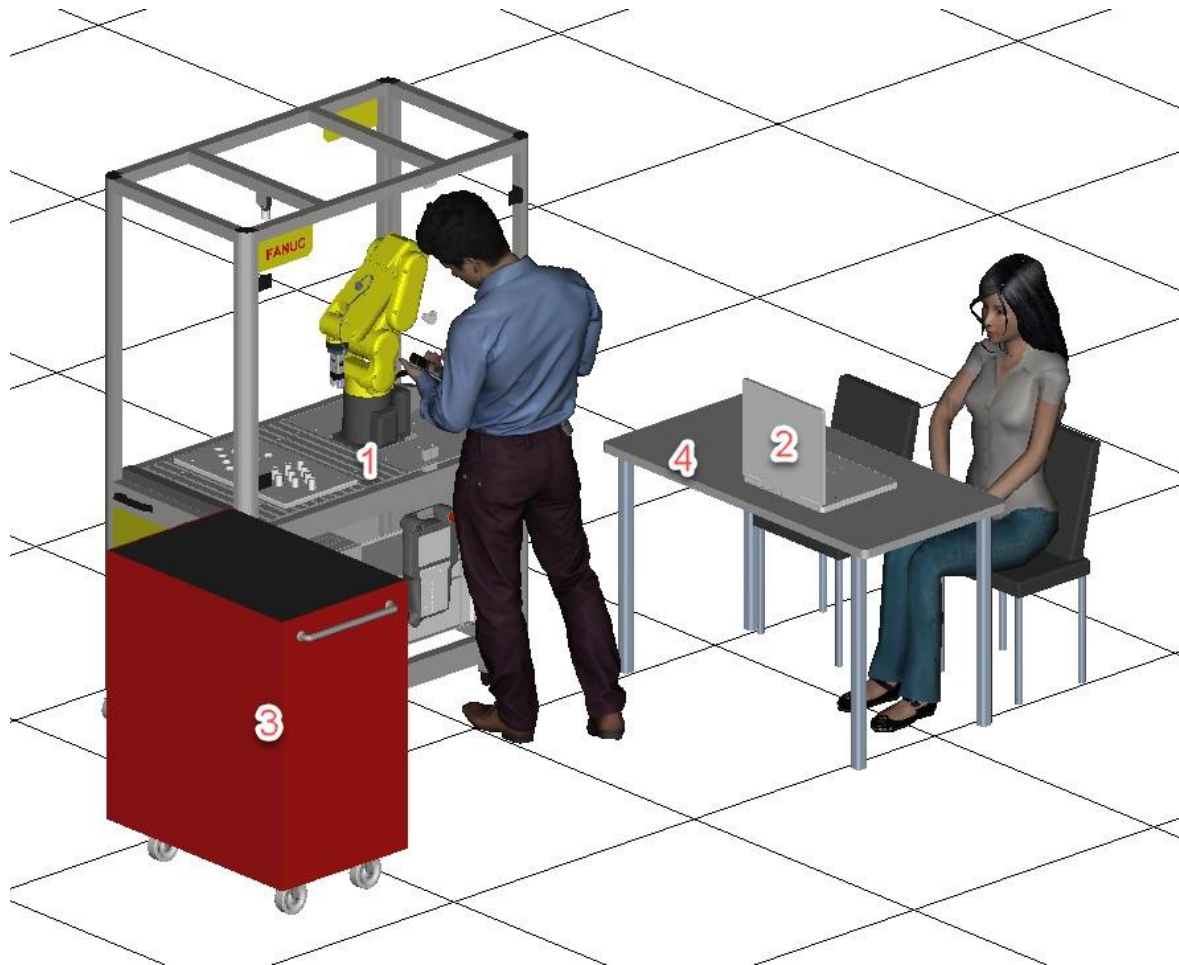


| 1 | FANUC Education Cell, modified to support a Competition-specific Test Project |
| --- | --- |
| | 經修改的 FANUC Education Cell 以支持競賽專用試題 |
| 2 | Laptop with pre-installed software: Roboguide/Sharepoint designer/Office etc |
| | 筆電及已預先安裝的軟體：Roboguide / Sharepoint designer / Office 等等 |
| 3 | Tool Trolley - containing all necessary Tools and Test project equipment including storage of Competitors PC (see section 6.5) |
| | 工具車－含所有需求工具和試題設備，如選手電腦的存放空間（請見第 6.5 項） |
| 4 | Tables and chairs for the Competitors |
| | 供選手使用的桌子和椅子 |
| 5 | Minimum space per team is 3 m x 4 m |
| | 每個團隊的最小空間為 3m x 4m |

## Wheelchair users 輪椅使用者

Most, but not all of the tasks can be carried out by Competitors in wheelchairs, for instance:

使用輪椅的選手能執行大部分的任務工作（並非全部），例如：

Simulation/Offline programming
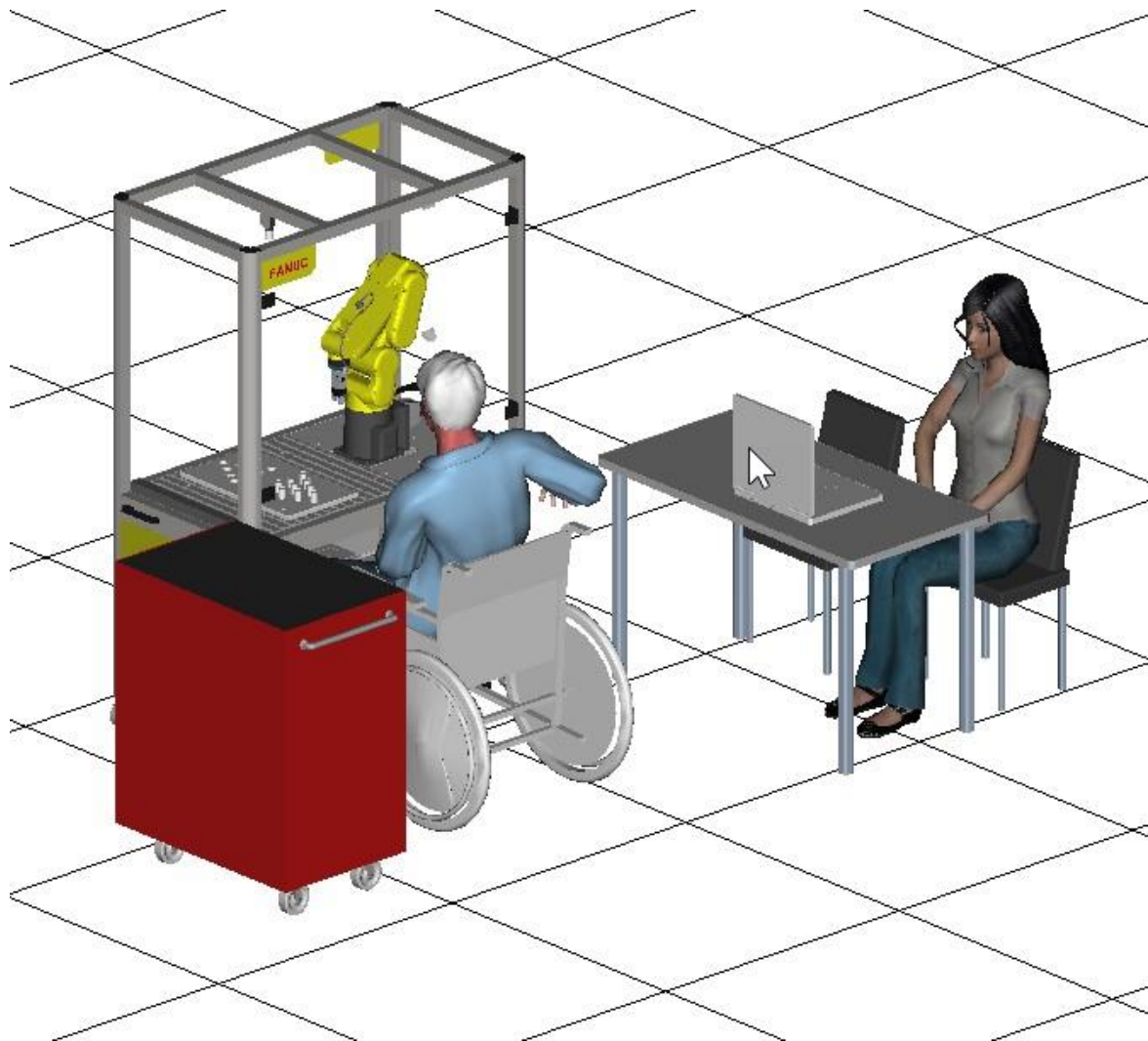
模擬／離線的程式設計

Robot/Vision System setup and programming

Documentation

機器人／視覺系統設定及程式設計文件

Some of the Electrical connections

部分電力連接



But other tasks such as mechanical installation inside the cell cannot be done from a wheelchair, so one team member could be in a wheelchair, but not both.

但其他任務工作，如系統內的機械安裝，則無法在使用輪椅的狀況下完成，所以，只能有 1 位成員使用輪椅，不能 2 位都使用輪椅。

# 9 Skill-specific rules 技能之特殊規定

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

技能之特殊規定不得違背或優先於競賽規則，提供不同職類間可能有所差異的明確具體細節，包括但不限於個人 IT 設備、資料儲存裝置、網路存取、程序與工作流程及檔案管理與發送。違反以下規定，將依包含倫理規範與行為守則懲處系統在內的問題與爭議解決程序解決。

| Topic/task | skill-specific rule |
|---|---|
| Use of technology – USB, memory sticks<br><br>科技產品的使用 – USB、記憶卡 | • Competitors are only allowed to use memory sticks provided by the Competition Organizer.<br>• 選手僅能使用競賽主辦單位提供的記憶卡。<br>• Memory sticks or any other portable memory devices cannot be taken outside the workshop.<br>• 記憶卡或任何可攜式記憶體裝置均不得帶出工作場地。<br>• Memory sticks or other portable memory devices are to be secured in the same manner as the Competitor PCs.<br>• 記憶卡或其他可攜式記憶體裝置的保管方式同選手電腦的保管方式。 |
| Use of technology – personal laptops, tablets, and mobile phones<br><br>科技產品的使用 – 個人筆電、平板電腦和手機 | • Experts and Interpreters are allowed to use personal laptops, tablets, and mobile phones in the Expert room only.<br>• 裁判和翻譯僅能在裁判休息室中使用個人筆電、平板電腦和手機。<br>• Competitors are not allowed to bring personal laptops, tablets, or mobile phones into the workshop.<br>• 選手不得將個人筆電、平板電腦或手機帶進工作場地。<br>• The Skill Management Team is exempt from this rule.<br>• 技能競賽經理則不在此限。 |
| Use of technology – personal cameras<br><br>科技產品的使用 – 個人相機 | • Skill Competition Manager, Chief Expert, Deputy Chief Expert, Experts, Competitors, and Interpreters are allowed to use personal photo and video taking devices in the workshop at the conclusion of the competition on C4 only.<br>• 技能競賽經理、裁判長、副裁判長、裁判、選手和翻譯僅能在競賽第 4 天結束後使用個人拍照和攝影設備。 |

# 10 Visitor and media engagement 觀眾與媒體參與

Following is a list of possible ways to maximize visitor and media engagement:

下列為能擴大觀眾與媒體參與的可行性方法清單：

- Display screens - some web cams could be dispatched on the Competition area and show details of the task to the public and on a website;

- 展示螢幕 - 部分網路攝影機可發放至選手區，向民眾並在網路上展示任務工作的細節；
- Test Project descriptions;
- 試題說明；
- Enhanced understanding of Competitor activity;
- 增進觀眾對選手活動的理解；
    - Competitor profiles - For each Competitor team provide a sticker with the national flag, the name of the Competitor and a brief description of their studies;

    - 選手個人資料 – 由各個選手團隊提供國旗貼紙、選手姓名和學習簡要說明；
    - Daily reporting of Competition status;
    - 選手狀態的每日報告；

- Do it yourself workshop - in the Robot System Integration workshop provide an area where young people and public can work with a Robot System – for instance a standard Education Cell. This activity could be managed by a students of from the Host Country/Region.

- DIY 工坊 – 在機器人系統整合工作場地中提供一個能讓年輕人和民眾操作機器人系統（如標準 Education Cell）的區域，此活動可由主辦國／主辦地區的學生安排管理。
- Display videos of typical Robot Systems and Applications.
- 播放代表性的機器人系統與應用影片。
- Large Industrial Robot could be installed as an eye-catching static display
- 可安裝大型工業機器人作為吸睛的靜態展示

The back side of the FANUC Education Cell, opposite to the opening side where the Competitors work, is a full-size plexiglass window – see below.

FANUC Education Cell 的背面，也就是選手作業開放區的對面，是一面全尺寸的塑膠玻璃窗，請見下圖。

This allows spectators a complete view of the robot application, without any safety issues.

讓觀眾能安全無虞地完整觀看機器人應用。

# 11 Sustainability 永續性

This skill competition will focus on the sustainable practices below:

該職類將關注下列的永續實踐：

- Recycling;

- 回收；
- Use of "green" materials;
- 使用「綠色」材料；
- Test Project, Robot and equipment manuals etc. provided in electronic rather than paper form
- 提供試題、機器人與設備手冊等等，應以電子檔提供，而非紙本形式

# 12 References for industry consultation

## 業界諮詢參考資料

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

WorldSkills 致力於確保 WorldSkills 國際職業標準能全面反映國際公認產業和企業最佳實務的活力，為此，WorldSkills 接洽了來自全球的許多組織，請他們每兩年針對相關角色說明草案和 WorldSkills 國際職業標準提供意見回饋。

In parallel to this, WSI consults three international occupational classifications and databases:

與此同時，WSI 也查閱了三個國際職業分類和數據庫：

- ISCO-08 國際職業標準分類：([http://www.ilo.org/public/english/bureau/stat/isco/isco08/](http://www.ilo.org/public/english/bureau/stat/isco/isco08/))
- ESCO 歐洲技能、資格和職業框架：([https://ec.europa.eu/esco/portal/home](https://ec.europa.eu/esco/portal/home) )
- O*NET OnLine 美國職業資訊網站([www.**oneto**nline.org/](www.onetonline.org/))

This WSOS (Section 2) appears most closely to reflect *Robotics Technician:* https://www.onetonline.org/link/summary/17-3024.01

And *Robotics Engineering Technician:* http://data.europa.eu/esco/occupation/7833d5cd-873d-4fdd-b2f8-9762d68494a7

WSOS（本文第 2 條）似乎最能夠反映*機器人技師*的一職：

https://www.onetonline.org/link/summary/17-3024.01

以及*機器人工程技師*：http://data.europa.eu/esco/occupation/7833d5cd-873d-4fdd-

b2f8-9762d68494a7

There were no responses to the requests for feedback this cycle.

在此週期期間，尚未獲得針對我們回饋需求的回應。

# 13 Appendix 1 附錄 1

## 13.1 Robot manuals and software functions

## 機器人手冊與軟體功能

| Topic 主題 | Sub-topic 次要主題 | Manual/document 手冊／文件 |
|---|---|---|
| Robot Setup<br>機器人設定 | Payload Calculation<br>裝載計算 | FANUC_Payload_Checker_V7_47.xlsm |
| | Tool connection etc.<br>工具連接等等 | LRMate200iD_operator_manual_[B-83494EN_07].pdf |
| | I/O connection and setup<br>I/O 連接與設定 | R-30iBMate_Plus_controller_maintenance_manual_[B-83525EN_07].pdf |
| Simulation<br>模擬 | Robot Simulation<br>機器人模擬 | Roboguide built-in help files<br>Roboguide 內建說明檔案 |
| | CAD Object Generation<br>CAD 物件產生 | Roboguide Modeller |
| Robot programming<br>機器人程式設計 | Standard TP Programming<br>標準 TP 程式設計 | R-30iB_Plus_basic_operator_manual_[B-83284EN_07].pdf |
| | Advanced TP programming ( PR[], LD, Skip etc.)<br>進階 TP 程式設計<br>（PR[]、LD、Skip等等） | |
| | Ethernet connection, file transfer etc.<br>乙太網路連線能力、檔案傳輸等等 | R-30iB_Plus_Ethernet_function_[B-82974EN04].pdf |
| Machine Vision<br>機器版本 | 2D Location Tools<br>2D 定位工具 | R-30iB_Plus_iRVision_2D_application_operator_manual_[B-83914EN-2_01].pdf<br>R-30iB_Plus_iRVision_reference_operator_manual_[B-83914EN_03].pdf |
| | 2D Inspection Tools<br>2D 檢驗工具 | |
| Human Machine Interface<br>人機介面 | iPendant Controls | iPendant_customization_guide_[V9.10][MARRUCSTO02171E_Rev.C].pdf |
| | MS Sharepoint Designer | |

| Documentation etc. | Word processor/Spreadsheet etc. | MS Office Word/Excel/PowerPoint |
|---|---|---|
| 文件等等 | 文書處理／試算表等等 | |