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Date: June 2016

The Cell Consists of:
KR210 Robot
KRC2 Edition 5 Controller with Windows XP and KSS 5.4.14
Global Robots Single Axis Turntable
End of Arm Tool Changer

Spindle with Auto Tool Changer supplied by High Gain Technology Ltd
Invertec Inverter supplied by High Gain Technology Ltd
Ten position tool rack supplied by High Gain Technology Ltd

Phoenix Controls Electrical Panel (with Cycle Start, Cycle Stop, Drives On and Reset PB)
Wago IO Modules on DeviceNet (32 Digital Inputs, 32 Digital Outputs, 1 Analogue Output)
Robot Mechanical Installation (by DFab Malta under the supervision of Phoenix)
Robot Electrical Installation (by DFab Malta under the supervision of Phoenix)
Robot and Turntable Commissioning
Turntable Integration with Root point and Offset definition

Offline programming using SprutCam Robot (Client supply)

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Scope Description in Detail:

Robot and Turntable:

For robot and turntable mechanical mounting, electrical supply.
Includes: Mounting stud, Nuts and washers, Resin, Supply cable X1, X1 Harting connector, 16mm Earth bonding cable and lugs.

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Control Panel:

The cell control panel contains all the circuit breakers, safety relays and safety circuits along with the Invertek inverter for the spindle and the Wago IO and the associated wiring.
Includes: Rittal enclosure.
3Phase to 24VDC PSU.
Main Isolator.
MCBs Robot and VSD.
Circuit Breakers for panel equipment.
Safety relays for Estop circuit and operator safety circuits.
Invertek Inverter.
Wago Digital and Analogue IO Modules. (32 Inputs, 32 Outputs and 1 Analogue Output)
To provide an interface between the robot controller and the peripheral equipment there are a number of digital inputs and outputs along with an analogue output module mounted in the cell control panel. The Wago IO is made up of a bus coupler which provides the field bus connection via DeviceNet between the DeviceNet connector on the top of the robot PC. (The robot comes with a DeviceNet master connection as standard) and the connector on the Wago coupler itself.
Terminal Strips for cable termination.
Cycle Start. (illuminated push button that will flash when the system is ready for a cycle start)
Cycle Stop. (illuminated push button available to be programmed by user)
Drives On. (illuminated push button to enable the drives ready for cycle start)
Reset. (push button to re-arm the safety relays after cell entry, pressed estop etc)
Red, Amber and green lamp stack. (indicates cell status)
Glands and consumables.
X11 cable for robot safety circuits. (Harting connectors)
X12 cable for spindle digital inputs. (Tool change and spindle monitoring, Hummel Connectors)
X13 cable for spindle digital outputs. (Tool changer, Hummel Connectors)
X14 cable for spindle power. (Hummel Connectors)
X15 cable for ten tool rack tool present inputs. (Hummel control panel, Harting on Tool Rack)
DeviceNet Cable between panel and robot controller.
Access door safety switch cable. (Ferrogard Safety Switch)

The electrical design of the control panel.
The control panel build at our workshop in Liverpool.
Full operational testing of the control panel.
Shipping of the control panel.

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Safety Guarding:

For safety the robot operations are separated from human intervention by guarding which is fitted with an access door (1.2 metres) that will stop the robot or spindle in the event of the access door being opened whilst the cell is running in automatic mode.

The cell operator or maintenance technician has the possibility of running the robot in teach mode with the cell access door open to allow for mastering of the robot and other setting up tasks although for robot movement the enabling switch on the teach pendant must be held in. It is not possible to run the spindle with the access door open.

The guarding is made up of 50mm x 50mm x 2253mm posts that are powder coated yellow with black panels also powder coated with 2" x 2" mesh.

The access door is fitted with a Guardmaster Ferrogard two channel safety switch.

This monitoring switch is integrated into the operator safety circuit on the robot controller via a safety relay in the main control panel such that a cell access door opening will stop the robot and spindle. It will not be possible to re-arm the safety circuits until the access door is closed.
The cell access doors are not locked but through the Ferrogard monitoring will stop the robot and spindles in automatic mode the moment either door is opened.

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Inverter, Spindle with Auto Tool Changer and Ten Position Tool Rack:

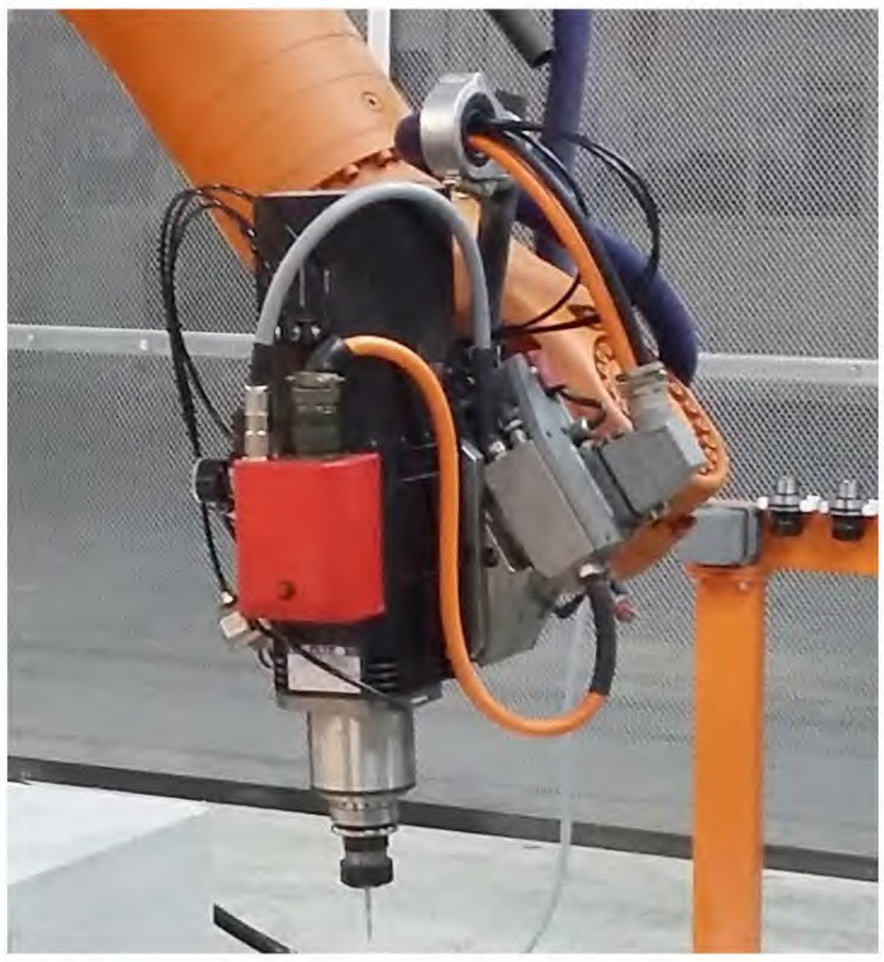
The control of the spindles will be via an Invertek inverter. The speed and starting/stopping of the spindle is managed from within the robot tool path program via the Wago analogue card and digital IO. The inverter is mounted in the control panel. The spindle will be interlocked with the Estop and operator safety circuits so that in the event of an Estop or entry into the booth in Automatic mode the spindle will stop.

The inverter receives from the control panel the following signals:

1. Safety input (removed in the case of Estop or cell access door open)
2. Run signal.
3. Speed control via analogue output (frequency to voltage conversion by subroutine)

The control panel receives from the inverter the following signals:

1. Inverter ok.
2. Inverter ready.



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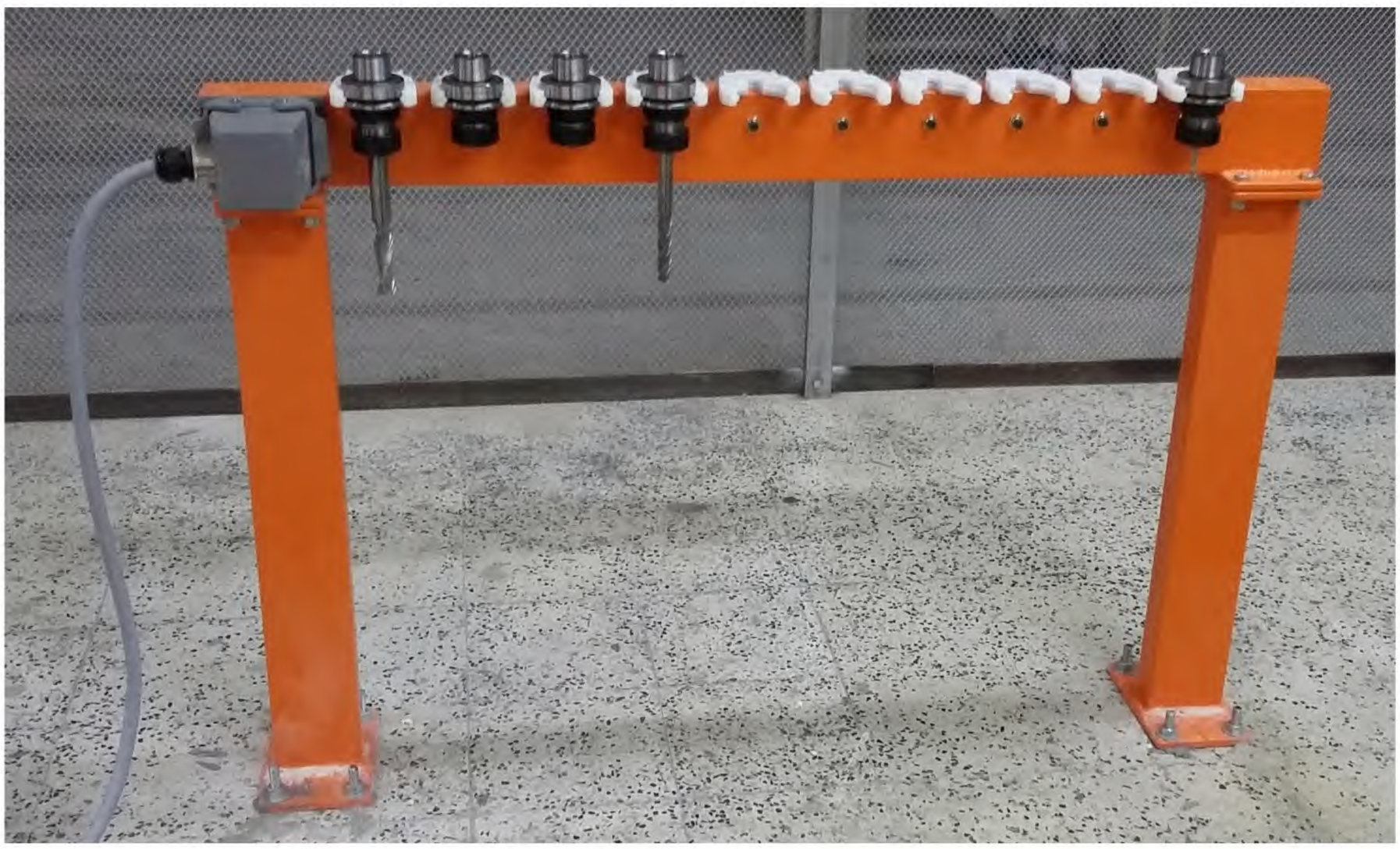
The ten position tool rack holds the tools that are not being used with each tool position fitted with a proximity sensor to indicate the presence of the tool holder.

The robot spindle is fitted with an auto tool changer whereby the robot runs through the following steps to carry out a tool change during the automatic cutting cycle.

1. The robot positions in front of the tool changer.
2. Confirmation (via internal detection in the spindle) that the spindle is no longer spinning.
3. Confirmation that there is no tool holder currently in the tool holder for the return position.
4. Move into tool holder.
5. Release tool holder and confirm that collet is open.
6. Move above tool holder.
7. Confirmation that tool holder is in tool rack and that there is no tool holder in spindle.
8. Move above tool holder of new tool and confirmation tool holder is present.
9. Move down to just above tool holder.
10. Air blast to clear any contamination from the tool holder.
11. Move down onto tool holder.
12. Close collet and confirm collet is closed.
13. Move forwards out of tool holder.
14. Confirmation that tool holder is no longer present in the rack.



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Installation, Commissioning, Programming and Training:

1. The mechanical installation of the robot (drilling the floor and fixing with resin filled studs).
2. The mechanical installation of the turntable (drilling the floor and fixing with resin filled studs).
3. The mechanical install of the dust extraction equipment.
4. The mechanical install of the spindle.
5. The mechanical install of the spindle cooling pumps.
6. The mechanical install of the tool rack.
7. The mechanical install of the guarding.
8. The electrical install of the robot and turntable (fixing down of containment, put in place and connection of the controller supply cables, data cables, motor cables and earth bonding).
9. The electrical install of the spindle (put in place and connection of the cables from the spindle, through the robot and to the control panel).
10. The electrical install of the dust extraction equipment (put in place and connection of the cables from the dust extraction equipment to the control panel).
11. The electrical install of the spindle cooling pumps (put in place and connection of the cables from the cooling pumps to the control panel).
12. The electrical install of the cell control panel (put in place and connection of the cables from the control panel to the main incoming supply, from the control panel to the door locks).
13. The commissioning of the robots (mastering, turntable root point and offset, floor defined working base data, and spindle tool definition).
14. The commissioning of the dust extraction system, spindles (in conjunction with HGT) cooling pumps (in conjunction with HGT), safety circuits (Estop and Operator safety) and control panel push button controls.
15. The programming of the auto tool changer sequences.
16. The offline programming of a trial piece for each robot and the turntable (in conjunction with Mastercam)
17. A four day basic programming and setup course.