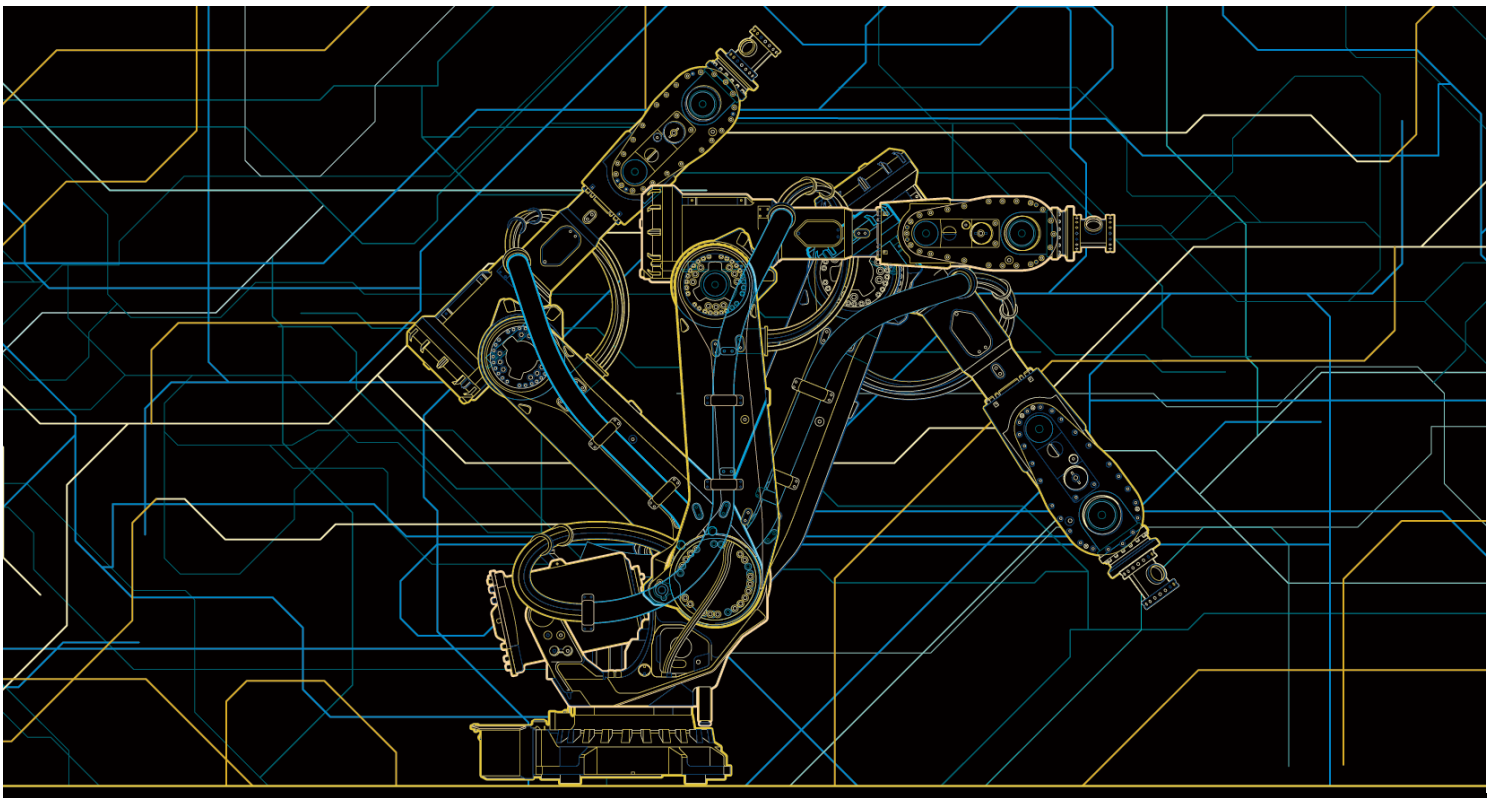

Product specification
Integrated Vision

Power and productivity
for a better world™

Trace back information:
Workspace R15-2 version a11
Checked in 2015-10-06
Skribenta version 4.6.081

Product specification
Integrated Vision

Document ID: 3HAC046868-001
Revision: C

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The original language for this publication is English. Any other languages that are supplied have been translated from English.

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Table of contents

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Overview of this specification

About this product specification

This product specification describes the functionality, performance, and options available for Integrated Vision in terms of:

- Application environment setting
- Basic concepts
- Ease of use of the software application configuration
- Interactions with robots, cameras, sensors, conveyors, and other peripheral equipment
- Operation and controls
- Software and hardware options and licenses

Usage

Product specifications are used to find data and performance about the product, for example to decide which product to buy. How to handle the product is described in the product manual.

Users

It is intended for:

- Product managers and product personnel
- Sales and marketing personnel
- Order and customer service personnel

References

Reference	Document ID
Product specification - Controller software IRC5	*3HAC022349-001*
Product specification - Controller IRC5 with FlexPendant	*3HAC041344-001*
Application manual - Integrated Vision	*3HAC044251-001*
Product specification - Robot user documentation, IRC5 with RobotWare 5	*3HAC024534-001*

Revisions

Revision	Description
-	New specification
A	Minor corrections/update
B	Minor corrections/update
C	Added the IRB 14000-specific stationary camera, In-Sight Micro 1402.

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1 Integrated Vision

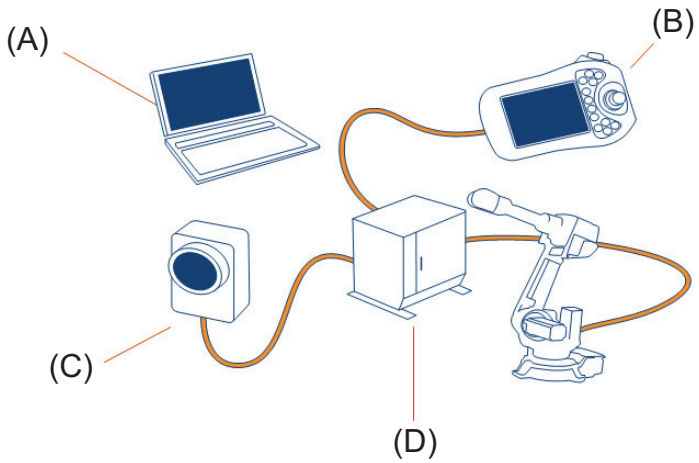
1.1 What is Integrated Vision

Introduction

The purpose of ABB's Integrated Vision system is to provide a robust and easy-to-use vision system for general purpose Vision Guided Robotics (VGR) applications.

The system includes a complete software and hardware solution that is fully integrated with the IRC5 robot controller and the RobotStudio programming environment. The vision capability is based on the Cognex In-Sight® smart camera family, with embedded image processing and an Ethernet communication interface.

RobotStudio is equipped with a vision programming environment that exposes the full palette of Cognex EasyBuilder® functionality with robust tools for 2D part location, part inspection, and identification. The RAPID programming language is extended with dedicated instructions and error tracing for camera operation and vision guidance.



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Position	Description
A	PC (Configuration from RobotStudio)
B	FlexPendant (Monitoring and simple maintenance)
C	ABB Smart camera
D	IRC5 (Connect up to 3 cameras)

1.2 Typical applications

Typical usage

The Integrated Vision system can reduce the need for hard automation and in some cases solve tasks that can only be implemented using vision technology. Typical applications include part positioning, visual part inspection, sorting, identification, and more. The time from acquiring an image until the image processing has completed typically ranges from 50ms up to 2s or more, depending on the complexity of the task. For more information, see *Does Integrated Vision solve your application? on page 25*.

Locating the part

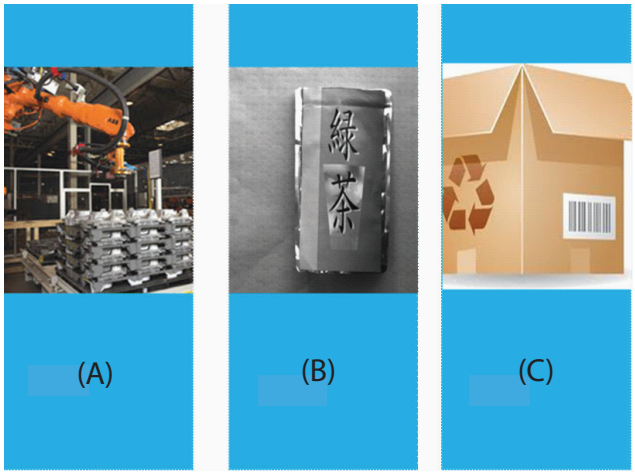
The vision system may be used as an alternative to mechanical fixtures to find the location and angle of the part in 2D. The vision system can be configured to find multiple types of parts – even simultaneously in the same scene if needed. Various vision tools are available ranging from simple and fast segmentation models that execute in a few milliseconds and up to complex feature based object recognition models with superior robustness.

Inspecting the part

The system comes with a large set of easy-to-use inspection tools tuned to a multitude of applications. Choose from simple operations such as brightness or sharpness measurements to complex pattern recognition operations. Multiple inspection tools and logic can be added as needed.

Identifying the part

With the Integrated Vision system the robot now also has the means to read text, bar codes, matrix codes etc. Thanks to the wide range of capabilities provided by the vision system it replaces an array of traditional sensors used in robotic applications.



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Position	Description
A	Find it

Continues on next page

Position	Description
B	Verify it
C	Trace it

1.3 Required equipment

The following software and hardware is required to run Integrated Vision:

- RobotWare version: 5.60 or later
- RobotWare option: 1341-1 Integrated Vision
- A PC with RobotStudio installed (for configuration, not required for production)
- RobotStudio Free version: 5.60 or later. Launch 32-bit version. DPI and text size shall be set to 100%.
- Main computer: DSQC1000
- Camera firmware: 4.08(22)
- FlexPendant: SxTPU3 (optional - FlexPendant may be used for viewing images)

Note

RobotStudio may be downloaded from "www.robotstudio.com". Integrated Vision can be used with the free version of RobotStudio. Cameras and RobotStudio connect through the service port of the main computer.

2 Overview of the product

Hardware

The camera system is based on the Cognex In-Sight® 7000 series, but any Cognex In-Sight® camera can be used. The camera is supplied with 24 VDC and Ethernet from the controller.

The kit cameras feature IP67 protection and C-mount lensing. Up to three cameras can be connected to the supplied Ethernet switch.

Software

- Integrated Vision provides easy-to-use vision guidance for the IRC5 robot controller.
- Simple installation and configuration of both cameras and robots from RobotStudio.
- Rich toolset of industry proven vision algorithms for various situations.
- Find, inspect and categorize parts using dedicated vision tools such as pattern matching, caliper measurements and barcode reading.
- Save time with dedicated RAPID instructions for camera communication.
- Monitor and record images from the FlexPendant during production.

Integrated Vision is installed as part of the RobotStudio and RobotWare software. The functionality is enabled with a RobotWare option (*1341-1 Vision Interface*).

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3 Technical specification

3.1 Hardware

Cameras

The following table provides the basic characteristics of the kit cameras provided by ABB. For additional details, see the technical specification of the camera, available on the RobotWare documentation DVD or the Cognex website. The ABB kit cameras DSQC1020 and DSQC1021 are electrically and mechanically equivalent to In-Sight 7200 and 7402 respectively.

Specification	DSQC1020	DSQC1021
Resolution	800x600	1280x1024
Sensor properties	5.3 mm diagonal, 5.3 x 5.3 µm sq. pixels, monochrome	8.7 mm diagonal, 5.3 x 5.3 µm sq. pixels, monochrome
Job/program memory	512 MB	
Image processing memory	256 MB SDRAM	
Sensor type	1/1.8-inch CMOS	
Shutter speed	16µs to 950 ms	
Acquisition	Rapid reset, progressive scan, full frame integration	
Lens type	C-mount	
Protection	IP67 with lens cover properly installed	
Power consumption	24DC 24±10%, 2 A External light - Continuously on; output 24V, 500mA max. External light - Strobe; output 24V, 1A max. at 50% duty cycle (max. on time of 100ms)	
M12 Lens, configuration, dimensions	75 mm (2.95 in) x 84.8 (3.34 in) x 55 mm (2.17 in)	
Operating temperature	0°C to 45°C (32°F to 113°F)	

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Lenses

It is important to select the correct lens before ordering a vision system. The tables below can be used as a guide when determining which lens provides the appropriate field of view. Note that the same lens results in different fields of view when used on DSQC1020 and DSQC1021 respectively. The reason is that the two cameras have image sensors of different sizes.

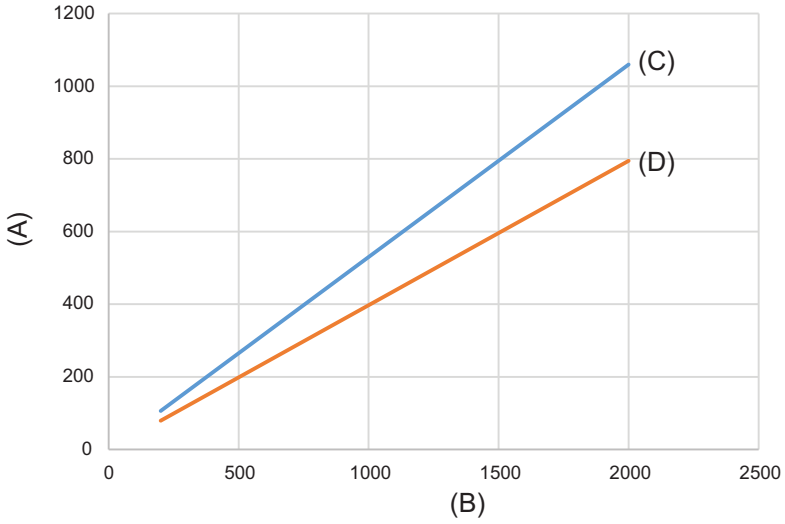

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Figure 3.1: DSQC1020 - 8 mm lens

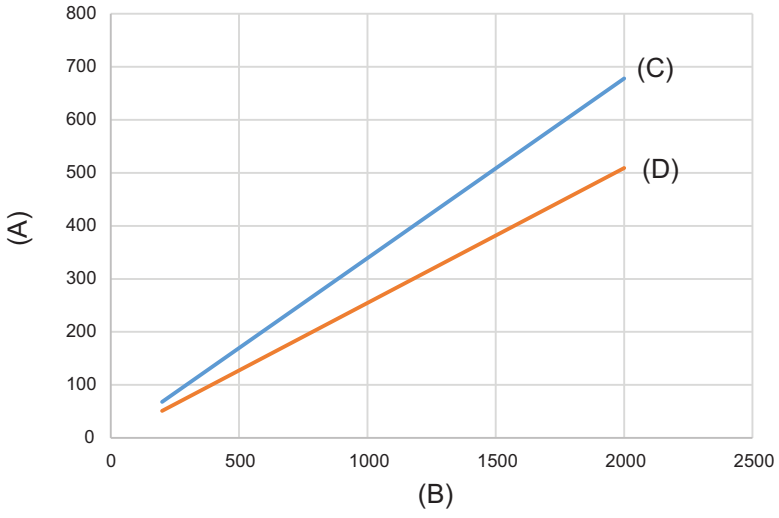

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Figure 3.2: DSQC1020 - 12.5 mm lens

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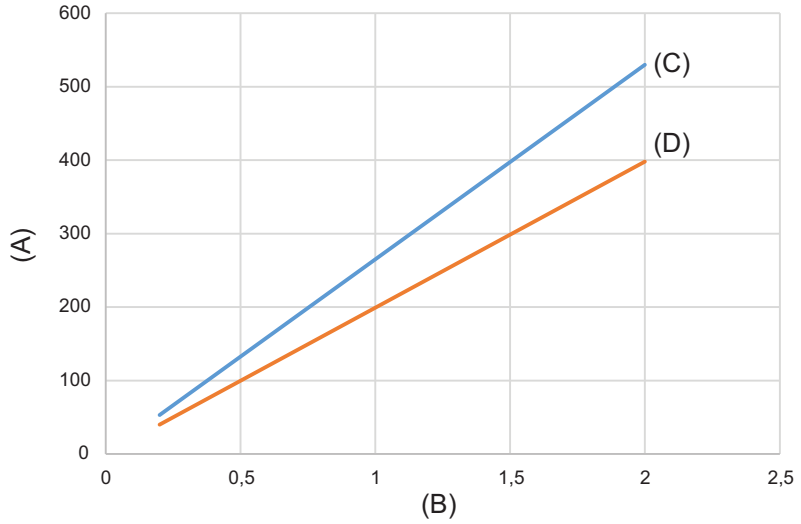

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Figure 3.3: DSQC1020 - 16 mm lens

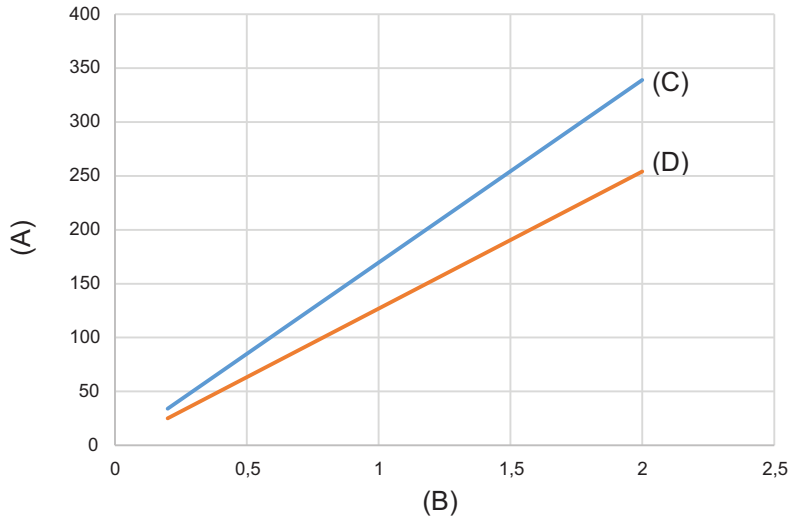

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Figure 3.4: DSQC1020 - 25 mm lens

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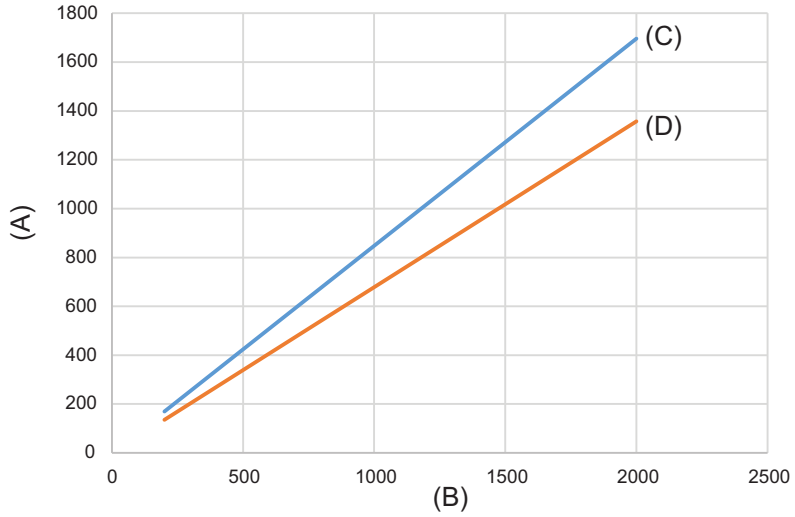

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Figure 3.5: DSQC2021 - 8 mm lens

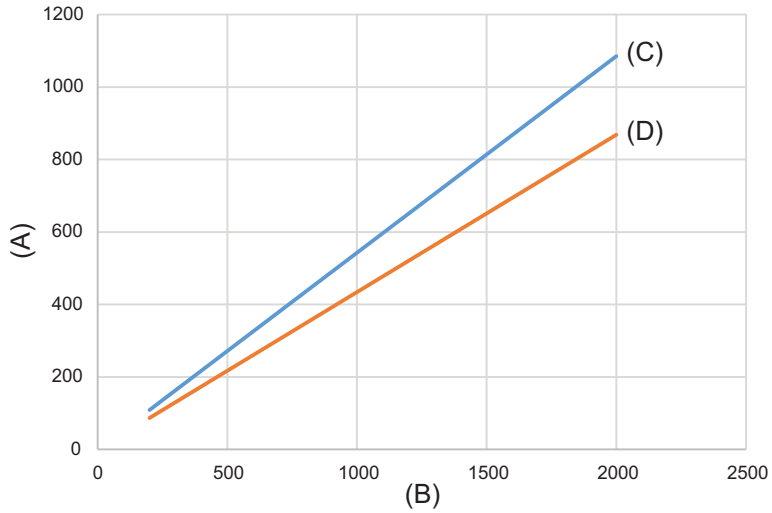

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Figure 3.6: DSQC2021 - 12.5 mm lens

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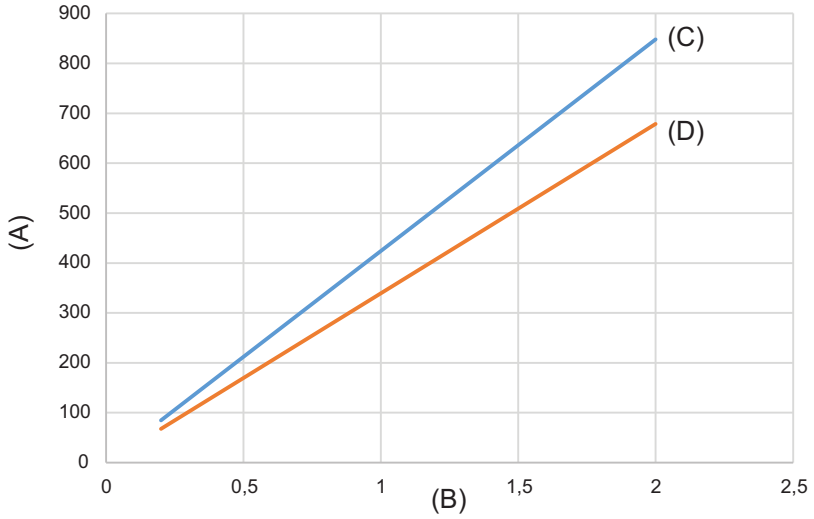

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Figure 3.7: DSQC2021 - 16 mm lens

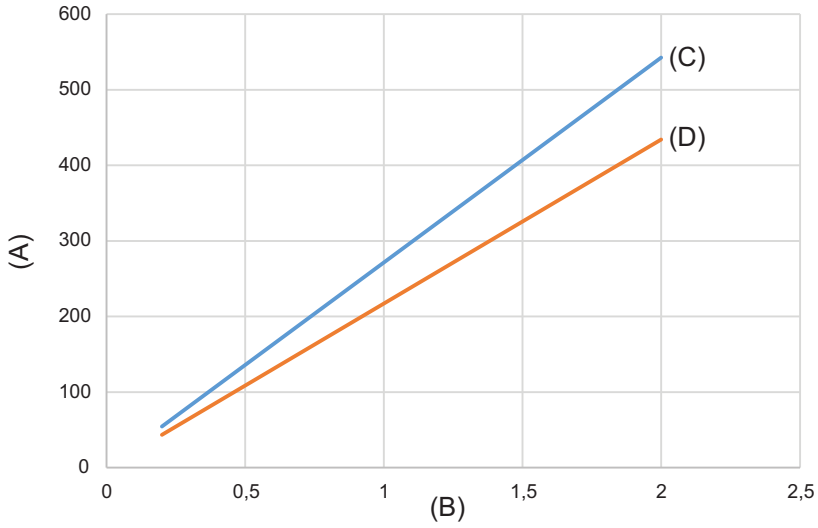

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Figure 3.8: DSQC2021 - 25 mm lens

Position (valid for all above diagrams)	Description
A	Field of view (mm)
B	Distance (mm)
C	Width (mm)
D	Hight (mm)

Continues on next page

Note

Appropriate lenses can also be calculated here:
http://www.cognex.com/ExploreLearn/UsefulTools/LensAdvisor/?id=8341

Input product and model: DSQC1020 = In-Sight 7200 and DSQC1021 = In-Sight 7402.

Selecting lens

Below is an example showing how to calculate the proper lens to be used, knowing the working distance between camera and work piece, and the required field of view. The example assumes that the user has selected DSQC1021.

Camera	DSQC1021
Maximum distance between camera and product	500 mm
Minimum field of view	200 x 200 mm

The example specifies that the FOV shall be at least 200 mm in both vertical and horizontal directions. Since the image is rectangular rather than square, it means that the shortest dimension, the height, has to be greater than 200mm. Figure "DSQC1021 - 12.5 mm lens" shows that at 500 mm both the width and height are greater than 200 mm. In this case an 8 mm lens would also work, but the resolution of the camera would not be fully utilized since the field of view would be larger than needed.

IRB 14000-specific stationary vision

Camera

The following table provides the basic characteristics of the IRB 14000-specific stationary camera, In-Sight Micro 1402.

Specification	In-Sight Micro 1402
Resolution	1280x1024
Sensor properties	8.7 mm diagonal, 5.3 x 5.3 µm sq. pixels
Job/program memory	128 MB non-volatile flash memory; unlimited storage via remote network device
Image processing memory	256 MB
Sensor type	1/1.8-inch CMOS
Shutter speed	16µs to 1000 ms
Acquisition	Rapid reset, progressive scan, full frame integration
Lens type	CS-mount and C-mount (with 5mm extension, included)
Protection	IP51 with cables and lens attached
Power consumption	6.49 W maximum per Class 2 PoE
Dimensions	30 mm (1.18 in) x 30 (1.18 in) x 60 mm (2.36 in) without mounting block 30 mm (1.18 in) x 38.2 (1.50 in) x 60 mm (2.36 in) with mounting block
Operating temperature	0°C to 45°C (32°F to 113°F)

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Lens

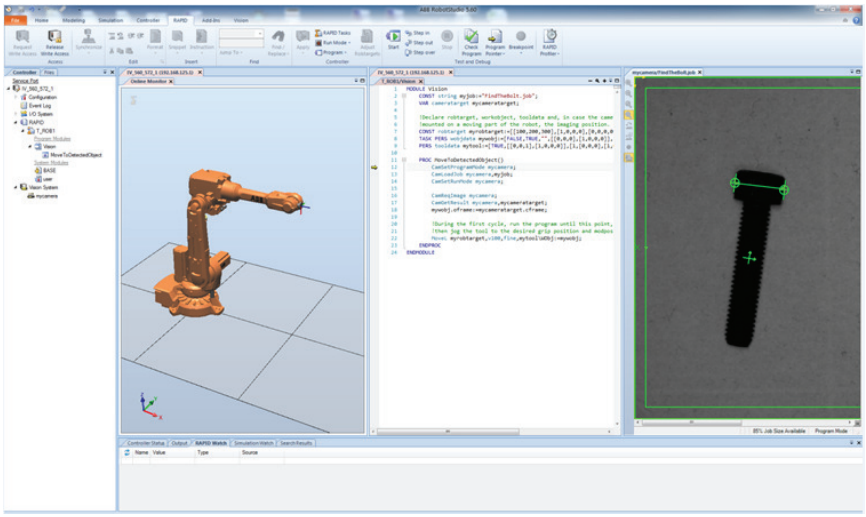
HF 12.5HA-1B is the lens used together with the IRB 14000-specific stationary camera In-Sight Micro 1402. The following table details the basic specifications of the lens.

Specification	HF 12.5HA-1B
Focus length (mm)	12.5
Iris range	F1.4-F16
Operation	Focus: manual Iris: manual
Angle of view (H x V)	2/3": 38"47' x 29"35' 1/2": 28"43' x 21"44' 1/3": 21"44' x 16"23'
Focusing range (from front of the lens) (m)	∞ - 0.1
Object dimensions at M.O.D. (H x V) (mm)	2/3": 78 x 58 1/2": 57 x 42 1/3": 42 x 32
Back focal distance (in air) (mm)	15.09
Exit pupil position (from image plane) (mm)	-31.3
Filter thread (mm)	M25.2 x 0.5
Mount	C
Mass (g)	45

3.2 Software

RobotStudio

RobotStudio is equipped with an additional tab that can be launched when connected to a robot controller with the option Integrated Vision. A graphical interface provides point-and-click instructions to assemble a vision task or "job". The vision tab offers a rich set of "vision tools" that can be used to solve a wide variety of applications. Rapid snippets are available to get off to a quick start.



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Note

The ABB kit cameras cannot be programmed with Cognex In-Sight Explorer.

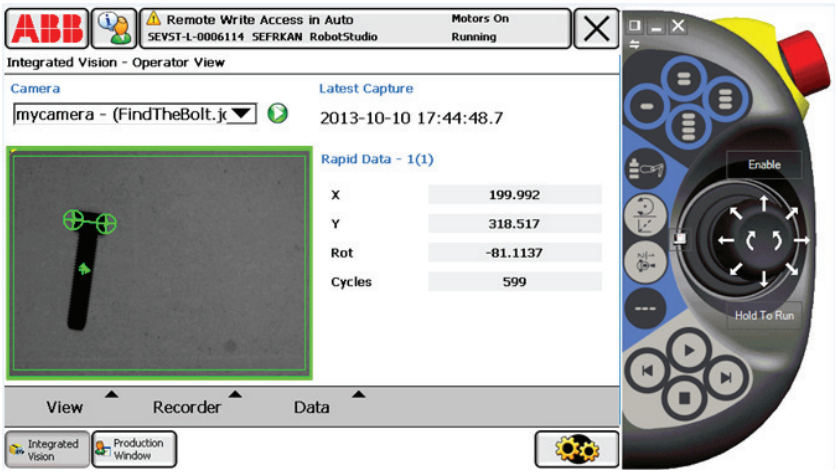
Robot controller

The RobotWare option Integrated Vision enables a set of dedicated instructions for communicating with the camera in an efficient manner. The instructions include commands for acquiring images, queue handling for the output as well as generic instructions for changing various parameters during runtime.

Continues on next page

FlexPendant

To eliminate the need for an additional operator panel the FlexPendant includes a vision application for monitoring images, observing result output, and saving images during run-time. The application can be configured so that the user may add favorite data to be displayed alongside the image.



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4 Does Integrated Vision solve your application?

When deciding to deploy a vision solution it is of critical importance to evaluate if the expected result can be achieved. The best way to make sure that required results can be achieved is to perform a test, and the closer the test setup is to the intended installation the better the result.

As good practice the following requirements shall be identified/quantified and verified:

Samples	Collect good and bad samples of the actual customer product to be used for evaluation.	OK
Accuracy	What accuracy is required? The overall number combines robot accuracy, influence by part variation, lighting etc.	OK
Tolerance	Can the part vary in size? Uniformly or irregularly?	OK
Cycle time	The vision system requires processing time. Depending on the application this may or may not affect the cycle time.	OK
Part positioning	Make sure you know the perspective from which the camera will observe the object. A simple thing like looking at the object from the side may affect the result.	OK
Variations in the process	Apart from the verified variables, can something else change?	OK
Lighting needs	Lighting is extremely important. Shield out ambient light and applying light that brings out the desired features of the part. Experimentation is the only reliable method.	OK
Physical space constraints	Taking all factors into consideration such as field of view, lighting solution, point of view – does everything fit together?	OK

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5 Stationary camera or mounted on the robot

General

Depending on the application requirements and physical constraints the camera may be mounted in different ways. Generally it can be said that mounting the camera on a fixed structure is more efficient unless requirements are such that the camera must be carried by the robot. When mounted on a robot the camera may be subjected to substantial force. For special considerations, see *Hardware on page 15*.

Stationary

A stationary camera generally provides faster cycle times since the robot does not have to stop on its path to acquire an image. Setup and calibration is generally easier with fixed cameras since the point from which the image is acquired is fixed. When mounting the camera on a fixed structure it is important that the camera is not subject to vibrations which can cause motion blur.

Mounted on the robot

When placing a camera on a moving position it is the responsibility of the user to make sure that the camera is not subjected to mechanical forces greater than what is specified in the camera specification. The cables are of a flexible type, but wear depends greatly on both the cable routing and the programmed robot path.

CAUTION

When using a robot held camera, or by other means moving camera, it is important to have a good cable routing.

When routing the cables caution has to be taken to avoid mechanical stress on the connectors, allowing sufficient bend radius for the cables, and minimizing the wear on the cables. It is also recommended to fit the cables with extra wear protection at the attachment points and at especially exposed areas.

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6 Sales options

Licensing

Integrated Vision is licensed as RobotWare option 1341-1. The software option enables the RAPID programming interface and FlexPendant operator panel. The vision programming tool in RobotStudio is free to use.

Note

It is highly recommended to always use Integrated Vision together with the option *Absolute Accuracy 603-1*.

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7 Specification of variants and options

Integrated Vision options

Option	Description	Remark	Description
1341-1	Integrated Vision interface	Requires 24V [727-1 or 727-3]	The option provides the software option that enables use of the RAPID vision instructions and the FlexPendant operator panel. The controller is also fitted with the necessary hardware to enable connection of up to three cameras.
Integrated Vision cameras			
1342-1	(1-3) Medium resolution camera	Requires Integrated vision interface [1341-1]	Camera DSQC1020 as specified in section *Cameras on page 15*. 10 m cables for EtherNet and Power I/O included with each camera.
1343-1	(1-3) High resolution camera	Requires Integrated vision interface [1341-1]	Camera DSQC1021 as specified in section *Cameras on page 15*. 10 m cables for EtherNet and Power I/O included with each camera.
Camera lenses			
1348-1	(1-3) 8 mm camera lens	Requires Integrated vision interface [1341-1]	Camera lens with focal length 8 mm as specified in section *Lenses on page 16*.
1352-1	(1-3) 12.5 mm camera lens	Requires Integrated vision interface [1341-1]	Camera lens with focal length 12.5 mm as specified in section *Lenses on page 16*.
1349-1	(1-3) 16 mm camera lens	Requires Integrated vision interface [1341-1]	Camera lens with focal length 16 mm as specified in section *Lenses on page 16*.
1350-1	(1-3) 25 mm camera lens	Requires Integrated vision interface [1341-1]	Camera lens with focal length 25 mm as specified in section *Lenses on page 16*.

IRB 14000-specific option

Option	Description	Remark	Description
IRB 14000-specific stationary vision			
1521-1	(1-2) High res. PoE camera	Requires IRB 14000-0.5/0.5 [435-131]	This option provides a package specific to IRB 14000, including camera, lens, adapter, cables and so on. Camera ISM1402 and related lens as specified in sections *IRB 14000-specific stationary vision on page 20*.

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8 Spare Parts list

Spare parts for Integrated Vision

Below is available spare parts for Integrated Vision listed.

Article number	Description
3HAC053944-001	8 mm C-mount lens
3HAC053944-002	12.5 mm C-mount lens
3HAC053944-003	16 mm C-mount lens
3HAC053944-004	25 mm C-mount lens
3HAC053953-001	DSQC1020 Camera Std Resolution for C-mount lens
3HAC053954-001	DSQC1021 Camera High Resolution for C-mount lens
3HAC051736-003	Ethernet cable 10 m
3HAC051736-004	Ethernet cable 15 m
3HAC051753-003	Power cable 10 m
3HAC051753-004	Power cable 15 m

Spare parts for IRB 14000-specific stationary vision

Below is available spare parts for IRB 14000-specific stationary vision listed.

Article number	Description
3HAC053166-001	Congex camera, ISM1402-11
3HAC053167-001	Congex LFC-12.5F lens
3HAC053168-001	Standard Ethernet cable 5m
3HAC053227-001	PoE adapter
3HAC024254-009	Ethernet cable, straight con. 3m

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