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Matsushita

Imagechecker P400 and P400S

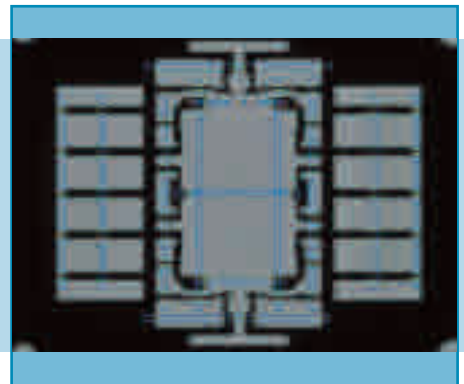
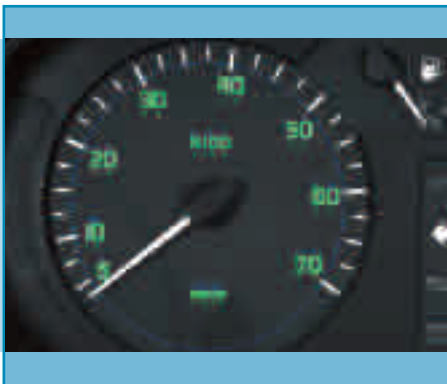
Industrial Machine Vision





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PC-Imagechecker P400 and P400S

Overview



P400

The P400 is a PC-based, multi-purpose, high-end Machine Vision System.

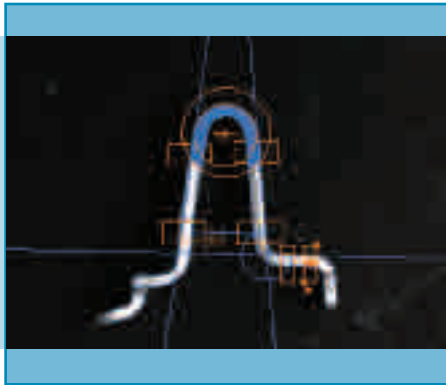
It is the ideal inspection tool if your application requires:

- High processing performance
- Various inspection functions
- Multi-camera processing with up to 12 cameras
- Extensibility in hard- and software

P400S

Especially if installation space is limited but you nevertheless need an innovative and powerful Machine Vision device that is PC-compatible, our compact P400S will prove the ideal solution. It uses the same software as P400 and works with up to 4 cameras.





Extremely user-friendly.

Multi-purpose for a wide range of industrial inspection applications.

High performance and cost effective.

Expandable in hard- and software.

A reliable and flexible partner:

P400 and P400S are complete PC-based vision systems. By selecting only high-quality components and developing a specially dedicated driver software, P400 and P400S hardware and software have been optimised to yield maximum performance and reliability. Furthermore, these systems prove that ease of use and flexibility are not contradictory.

P400, P400S Hardware (page 6-9)



P400



P400S



Vision P400 Software (page 10-17)





Imagechecker P400S

Hardware



Ultra Compact Design

We succeeded in packing a high-performance Machine Vision system into a very compact format. With a size of only 91 x 110 x 182 mm, P400S saves space yet offers all the features you expect from a mature and serious quality-inspection tool.



Latest Vision Technology

A careful combination of the latest computing technology and selected image processing hardware yields robust, fast and precise industrial Machine Vision. The system comes equipped with our Vision P400 software, which is based on one of the most advanced image processing libraries in the world. Expert knowledge is only one mouse-click away.



Solid, powerful and reliable

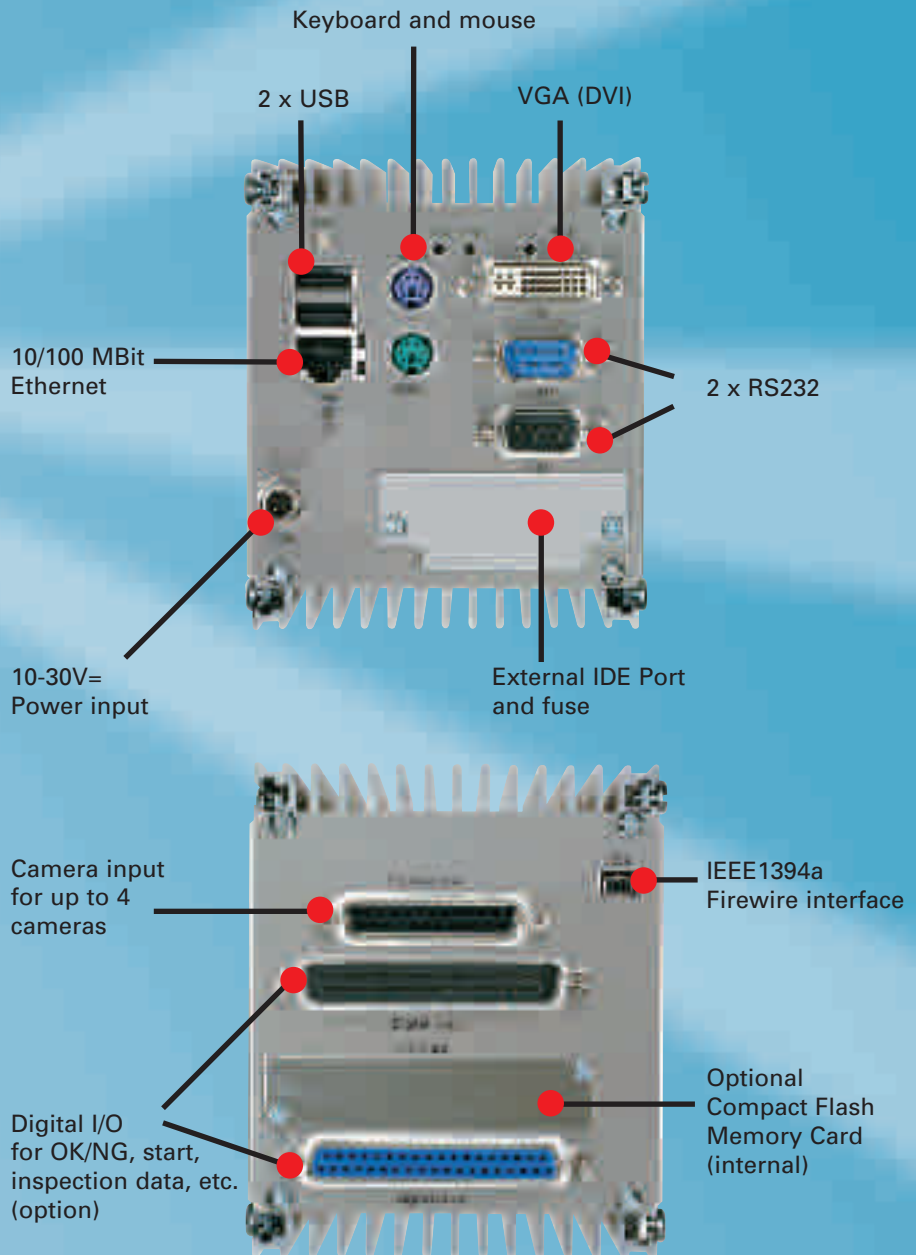
P400S offers the performance and stability of a dedicated, stand-alone and high-speed Machine Vision System. Nevertheless, it is 100% PC-compatible, thus combining all the merits and comforts of PC technology with industrially proven hardware.



Highlights:

- Compact and powerful inspection system
- Cost efficient multi-camera architecture
- All-round inspection tools and interfaces

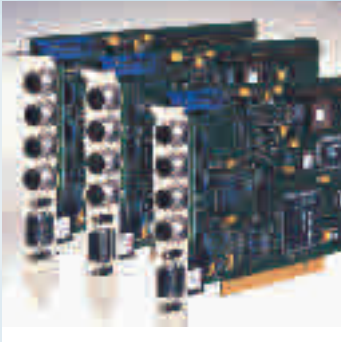
Interfaces:





PC-Imagechecker P400

Hardware



Expandable

The system can be upgraded with up to two additional camera boards, which will be detected automatically by the software. P400 comes equipped with standard interfaces such as RS232, USB, Ethernet and even a digital I/O card. Furthermore, several unoccupied PCI slots offer added flexibility for your future needs.



Fast

The combination of carefully selected, fast hardware components and a specially developed driver software gives P400 real high-speed inspection capabilities. For example, extracting more than 1,000 object features takes less than 50ms.



Designed with the customer in mind

The PC-Imagechecker P400 is based on a powerful IBM-compatible industrial computer and offer several important and convenient:

- Rugged metal housing with attachable 19" mounting brackets
- Lockable front door
- Changeable hard-disk drive for easy maintenance
- CD-RW drive
- Fan with removable dust filter
- 3-point attachment for all slot-cards
- Keyboard and mouse can be connected on the front or back





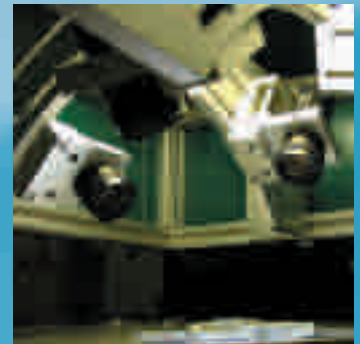
Highlights:

- High performance and multi-purpose system
- Scalable thanks to modular concept
- Industrially proven with excellent connectivity



Multi-camera processing

The P400 is able to operate with up to 12 cameras in serial input mode or 6 cameras while capturing images in parallel. Users may select from different CCD-matrix camera types, from basic types to mega-pixel types.



Designed for use in industry

During the development of the PC-Imagechecker P400, Matsushita attached great importance to designing a durable system suitable for industrial use. The P400 system has been thoroughly tested with regards to vibration and shock. Furthermore, each single P400 component has to pass an extended quality test before being used for the production of a system. Each single P400 system has to withstand a 48-hour test run. Due to its slot-CPU architecture, servicing a P400 system is easy.



Safe investment

In times of shortened product life cycles, protecting your investment long-term becomes increasingly important. P400's flexible architecture and use of high-quality, standard component guarantees this: soft- and hardware can be easily updated and upgraded at any time.





Vision P400 Software

Overview

Menu bar

Here all basic settings can be made, e.g. opening and saving an application, selecting the frame grabber, specifying a password, processing a spreadsheet, etc.

Vertical toolbar

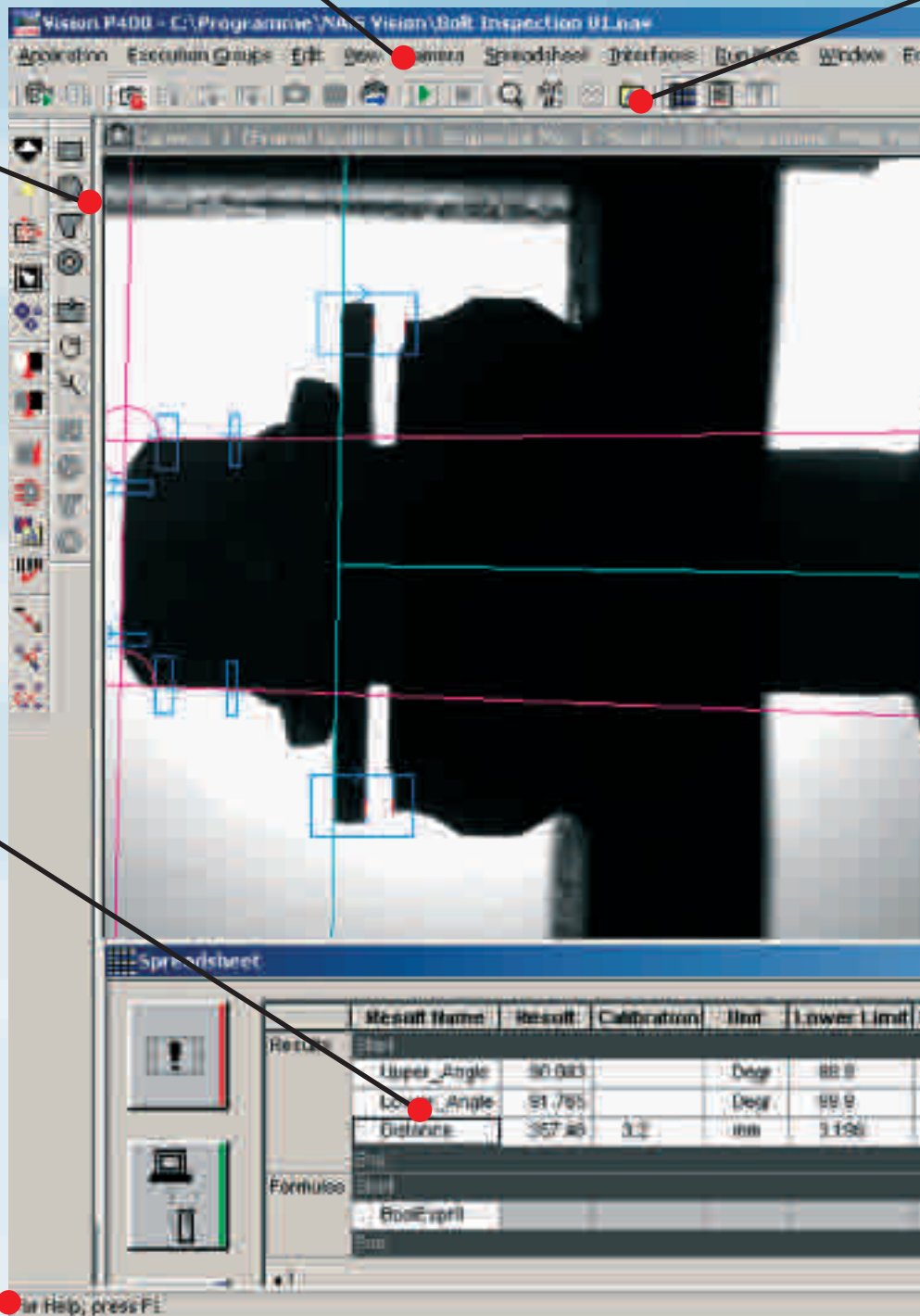
The icons on the left-hand bar are used to select a checker. With an icon from the right-hand bar, the checker window shape can be selected. The size and position of the window defined can be modified at will using the mouse.

Spreadsheet

The spreadsheet is a special dialogue box for displaying and optimising the individual parameters and results. The drag & drop facility can be used to optimise limit values. Statistics can be prepared and checking results assigned to the interfaces. Action commands assist in analysing test objects which have been recognised as being faulty.

Status bar

Information about the effect of selecting a menu item or icon is provided here.





Horizontal toolbar

Includes various icons, e.g. to start the application or test the checkers. From here the inspection program can be started manually, and helpful diagnostic tools such as an error display or interface monitors can also be launched.

Image area

In this window the video image of the camera in question is displayed. The display can be toggled between the direct live image and the saved image. The display makes use of a 256-step gray scale.

Name	Dependencies	Time[ms]	Comment
ED_G(1,2)		2	Lower bolt edge left
ED_G(1,3)		1	Upper Bolt edge left
ED_G(1,4)		1	Upper Bolt edge right
ED_G(1,5)		1	Upper bolt edge front
ED_G(1,6)		1	Lower bolt edge front
ED_G(1,7)		1	Lower bolt edge right
ED_G(1,7)		5	Upper flange
ED_G(1,8)		4	Lower flange
ED_G(1,9)		3	Upper thread
ED_G(1,10)		3	Upper thread
FE(1,1)		1	
G_LL(1,1)	ED_G(1,2) ED_G(1,1) ED_G(1,5) ED_G(1,6)	0	Lower bolt angle
G_LL(1,2)	ED_G(1,4) ED_G(1,3) ED_G(1,5) ED_G(1,6)	0	Upper bolt angle
G_PL(1,2)	FE(1,1)	0	Center flange
G_PL(1,1)	ED_G(1,7)	0	

Process image: 23

Checker dialogue box: ED_G(1,1)

Checker dialogue box content:

- General
- Algorithm
- Adjustment
- Adjustment Width
- Shape
- Dependencies
- Judgement
- Result

Checker dialogue box also shows a grayscale image of the bolt and a histogram with a yellow limit line.

The sequence scroll bar

Provides an overview of the checkers set. This is also where the order in which the checkers run can be specified, and where the user can jump to the corresponding dialogue box of the checker by simply clicking on the bar.

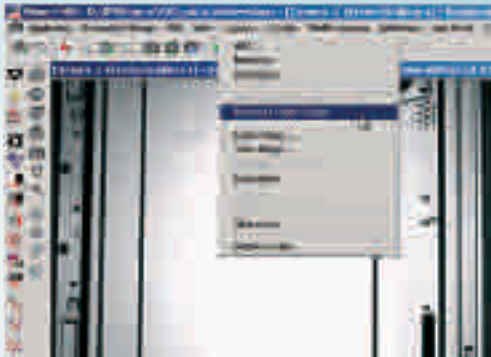
Checker dialogue box

This is where limit values are defined, results retrieved, or even filter settings made. Each checker has its own dialogue box and thus can be adjusted individually to the application.



Vision P400 Software

Features



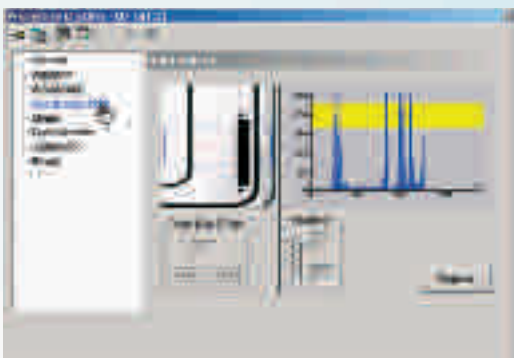
Icons, toolbar, drag & drop

The Vision P400 software sets a new standard in user-friendliness. It is mostly self-explanatory and runs under the operating system Windows 2000 therefore many users will already be familiar with basic procedures. With the aid of icons, toolbars and status displays, even sophisticated applications can be configured quickly, securely and efficiently. No previous programming knowledge is required.



Fully equipped

The wide range of Checkers makes P400 suitable for sorting, counting, precise 2D measurement, presence checking, position detection, surface inspection, feature extraction, object identification, shape/contour inspection, OCR, OCV and much more. Thus the system is well equipped for the majority of visual inspection tasks.



Click & check

"Checkers" is synonymous with ready-to-use image processing routines, and P400 offers many by a simple mouse-click. The user benefits from the rich store of Matsushita experience to find a solution for a wide range of machine vision applications. Every checker has its own property sheet where parameters and limit values relevant to the task at hand can be defined, tested or changed. Moreover, the functional and timely suitability of the routine can be checked at any time.





Highlights:

- Fast and easy visual setup
- Large amount of ready-to-use inspection tools for almost any application
- Customisable

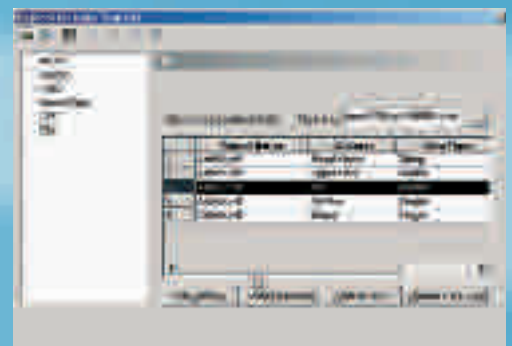
Transparency

The spreadsheet allows you to display and edit judgement values and inspection results at any time. Statistical functions and analytical tools help to optimise the inspection sequence and also to find critical aspects of the production process. Furthermore, the spreadsheet very easily gives access to P400's hardware and software interfaces.



Communication

In addition to the obligatory hardware ports, Vision P400 supports two software interfaces - named pipe and OLE automation - enabling the system to communicate with other Windows software. Special events such as repetitive errors can be assigned to special actions, e.g. storing the faulty image or halting the system. Dragging a spreadsheet cell to the "File Button" will archive the cell's content/result to a file after inspection.



Stability

Vision P400 offers many useful image pre-processing functions such as an exposure adjustment, which compensates potential fluctuations in environmental brightness. The position/rotation adjustment ensures correct inspection if the object's position varies. Several filter functions help to optimise the image quality prior to the real evaluation. All these functions significantly improve inspection stability for critical applications.





Vision P400 Software

Inspection Functions

Object Identification and Position Detection made easy

Vision P400 includes several algorithms which allow fast, reproducible and precise recognition, identification and location of objects. Our powerful Contour-Matching Checker is an especially impressive tool for such inspection tasks. It evaluates objects based on previously trained models, judging geometric information instead of pixel patterns, thereby achieving revolutionary stability and detection speed. Furthermore this algorithm can handle all those disruptive factors, which often disqualify conventional inspection methods for the real factory environment: fluctuating illumination, changing object appearance, touching and overlapping objects.



Gray value image



Contour template

Inspection and verification of Characters, Codes and Prints

P400 systems offer various tools to check the quality and completeness of complete prints, to read strings of characters (**O**ptical **C**haracter **R**ecognition), to verify strings (**O**ptical **C**haracter **V**erification) or to read a variety of different codes. The employed techniques guarantee high reliability and precision even under severe inspection conditions.

OCR/OCV

A powerful tool to read and verify characters, strings and symbols. We have expanded the functionality of this checker. Now, also rotated or even curved strings can be read.



Print Inspection

Typically blurred or incomplete imprints have to be detected. P400 is able to localise quality deviations which can barely be seen by the human eye.



2D Code reading

This newly developed Checker reads 2D-codes such as Datamatrix, ECC200 and QR code. Regardless of whether the codes are randomly twisted or serious changes in brightness occur, this powerful checker will read them reliably. Setting the checker is as easy as drawing a rectangle.



Barcode

Almost any barcode can be read with this tool. 2/5 Industrial, Code 39/93/128, EAN 13, EAN 8, UPC-A/E, and Pr Pharma Code are just a few examples.





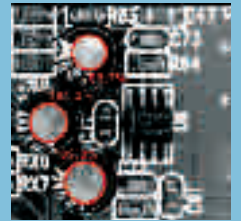
Impervious to fluctuations in illumination

Taking into account real factory-floor environments this inspection tool is not influenced by changes in ambient light or even variations in the object's appearance.



Scaling permissible

No matter if the parts vary in size or change their shape slightly, the Contour Matching Checker will find them reliably. Tolerances can be set from 50% to 200%.



Accepts missing/overlapping objects

Object can touch or even overlap rendering costly fixtures for separation unnecessary.



Permitted Rotation

Object identification will be performed, regardless of whether objects are rotated.



Measurement, Sorting, Counting...

2D Measurement

No matter which kind of measuring has to be performed, Vision P400 offers the right tools: distances, radii, areas, perimeters, roundness and much more. Depending on the field of view and the camera connected, μm -resolution can be achieved.



Positioning

Using special algorithms, P400 systems reach a resolution of up to 1/2000 pixel for positioning applications. The teach-in procedure merely requires that you show the system a reference image.



Assembly Inspection

Five different ready-to-use algorithms are available to check whether the right part is at the right position, from simple presence checking applications of single parts to inspection of complex component assemblies.



Sorting, Counting, Parts Recognition

Even objects which look quite similar can be distinguished reliably and quickly. For example, our Feature Extraction checker evaluates up to 20 object criteria (such as perimeter, area, centre of gravity, etc.) in only 22 ms.





Vision P400 Software

Inspection Functions

Checker

Applications

Example

Window Checker



- Presence check
- Sorting
- Area measurement
- Surface inspection
- Parts recognition



All rolls present?

Binary Edge Detection



- Fast measurement of length and distance
- Fast angle measurement
- Presence checking



Width of tracks correct?

Gray Value Edge Detection



- High accuracy measurement of length and distances
- High accuracy angle measurement
- Coplanarity check
- Surface inspection



All dimensions within range?

Difference Checker



- Print checking
- Punch checking
- Quality check of injection moulded parts
- Surface inspection



Print okay?

Feature Extraction



- Counting objects
- Presence check
- Position detection
- Roundness check
- Parts recognition

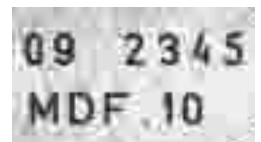


Benching radius correct?

Optical Character Recognition (OCR)



- Read, identify and verify:
 - Plain writing
 - Laser prints/thermal prints
 - Logos
- Object recognition



Correct lot number?

Code Reader¹⁾



- Read codes:
 - Barcodes: 2/5 Industrial, Code 39/93/128, EAN 8, EAN 13, UPC-A, UPC-E
 - 2D-Codes: ECC200, QR-Code



Contents of the code?

Contour Matching



- Position detection (0-360°)
- Object identification
- Presence check



Position of the pieces?

Vision P400 Software

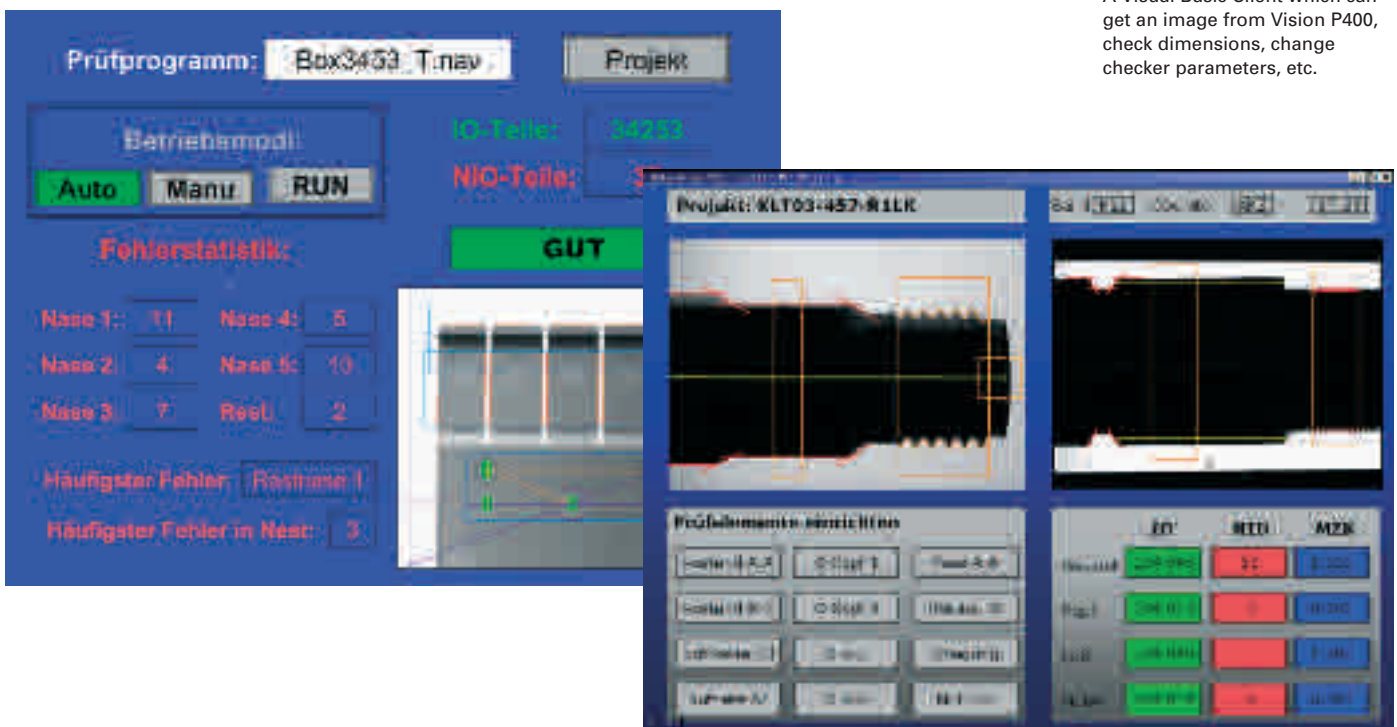
Customisation

Tailor-made user interface via ActiveX®

ActiveX controls use Microsoft's COM technologies to communicate with other MS Windows applications such as MS Excel or custom programmed software clients. The implementation of P400's ActiveX Control is well supported by almost every open-standard programming language, e.g. Visual Basic or Visual C++. Thus, creating a specific and individual user interface for Vision P400 can be easily realised.

Example:

A Visual Basic Client which can get an image from Vision P400, check dimensions, change checker parameters, etc.



Supported features:

Receive images from Vision P400

These images can contain individual graphical elements such as markers or indicators.

Receive inspection results from Vision P400

Inspection results can simply be displayed or used for further calculation, e.g. statistics.

Control Vision P400

All necessary synchronisation signals can be sent and received.

Change Checker parameters

For example, change the inspection region of a checker, change filter settings of a checker.

More than 50 ActiveX methods to adjust Vision P400 to your needs

Save other applications, set passwords, change applications, change inspection tolerances and much more.



PC-Imagechecker P400 and P400S

Specification

P400 Controller	
Processor	Slot CPU with Intel Pentium Processor
Memory	512MB (max. 2,048MB), DDR DIMM
Cameras	Max. 12 CCD cameras / serial image grabbing Max. 6 CCD cameras / parallel image grabbing
Drives	<ul style="list-style-type: none"> Removable hard-disk 20GB (or more) 3.5" floppy drive, 1.44MB CD-RW drive
Interface	<ul style="list-style-type: none"> 2 x serial RS232C 1 Centronics interface 1 digital I/O card: 16 inputs/16 outputs 2 x USB 2 x 12 VDC power supply (each 400mA) PS/2 keyboard and monitor connections Dual LAN Port 10/100 Mbit Option: PROFIBUS interface
Housing	<ul style="list-style-type: none"> Industrial enclosure with fan and lockable front door Dimension (L x W x H) : 440 x 455 x 177mm 19" rack-mounting kit included
Mouse (included)	3 buttons
Miscellaneous	<ul style="list-style-type: none"> Key-operated switches on the front Displays LEDs: power, HDD Front connections for mouse & keyboard 550W Power Supply

P400S Controller	
Processor	Intel Processor
Memory	512MB, SDRAM
Cameras	Max. 4 CCD cameras / serial image grabbing Max. 2 CCD cameras / parallel image grabbing
Drives	<ul style="list-style-type: none"> Hard-disk 10GB (or more)
Interface	<ul style="list-style-type: none"> 2 x serial RS232C 1 digital I/O card: 16 inputs/16 outputs (option) 2 x USB 1 x CF-card slot PS/2 keyboard and monitor connections (VGA/DVI) LAN Port 10/100 Mbit 1 Firewire (IEEE 1394)
Housing	<ul style="list-style-type: none"> Industrial metal enclosure with fan Dimension (L x W x H) : 180 x 110 x 90mm Optional: DIN-rail mouting kit
Mouse (included)	3 buttons
Miscellaneous	<ul style="list-style-type: none"> Displays LEDs: power, HDD USB memory stick 64 MB included 2 m power supply cable included

Camera	Standard	Megapixel
Type	Progressive Scan 1/3" CCD	Progressive Scan 1/2" CCD
Resolution	648 x 492 pixels	1.380 x 1.035 pixels
Shutter speed	1/15 to 1/10.000 s	1/16 to 1/8.000 s
Lens mount	C-Mount	
Dimensions	29 x 44 x 66 mm (L x W x H)	
Connecting cables	3 m, 5 m, 10 m, or 15 m	

Matsushita Machine Vision

Other Products



Vision-Sensor LightPix AE10

Our newly developed Vision Sensor LightPix combines the ease of use of a conventional photoelectric sensor with the inspection possibilities of an entry-level vision system. It is fast, reliable and cost-effective.



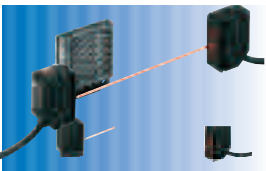
Compact Machine Vision Systems Imagechecker A100/200

For more sophisticated applications, the A-Series is the next step. With dimensions of just 120 x 40 x 70mm, the A-Series Imagechecker is one of the smallest of its kind. It allows high-speed, dual-camera processing (A200) with a robust and mature stand-alone hardware.



Colour Image Processing Systems AX30/AX40

Once colour-related product failures require detection, AX30/AX40 is the perfect solution. It evaluates the images of up to two cameras with respect to minute colour differences, checks objects' features, measures dimensions, compares patterns and much more.



Sensors

SUNX is the brand name for our sensor products. Whatever type of sensor is required, our wide product range offers you the right solution.



Programmable Logic Controllers

Programmable Logic Controllers from Matsushita represent "Control advantages" that pay for themselves right from the start.



Human Machine Interfaces

Our compact size, bright and easy-to-read Human Machine Interfaces can be used to visualise inspection results. Touch panels can even replace the standard keypad if you so desire.



FA Components

Components such as power supplies, timers, counters and limit switches round off our wide product range. Proven and excellent Matsushita quality throughout the whole range of Factory Automation products.



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