

DEVELOPMENT OF AN ALGORITHM FOR REMOTE CONTROL OF A PAINTING ROBOTS

associate professor t.f.f-d (PhD) A.Yusupov

Andijan Machine-building institute,

Head of the department, associate professor

E-mail: azamat7uzbek@gmail.com

+998 97 7810960

M.Abdukarimov

Master's degree of

Andijan Machine-building institute

E-mail: azamat7uzbek@gmail.com

+998 97 7810960

Annotatsiya. *Ushbu maqolada bo'yash uchun ishlatiladigan robot-manipulyatorlarni boshqarish masalalari ko'rib chiqiladi. Bo'yash jarayonida qo'llaniladigan aplikatorlar, boshqaruv sxemalari va algoritmlari ishlab chiqilgan.*

Kalit so'zlar. *Avtomobil kuzovlarini bo'yash, robotlarni bo'yash, tashqi yuzalarni, kirish mumkin bo'lmagan joylarni, birinchi seriyali bo'yash robotlarini, Trallfa ABB robot tizimini, I/P konvertorini, atomizatorni, siqilgan havo tarqatish moslamasini, bo'yoq aralashtirish moslamasini, nasoslarni, boshqaruv blokini, pnevmatik purkagichlar,*

Annotation. *This article deals with the issues of controlling robot manipulators used for painting. Applicators, control schemes and algorithms used in the painting process have been developed.*

Key words. *Painting car bodies, Painting robots, Exterior surfaces, Inaccessible areas, First serial painting robots, Trallfa ABB Robotic system, I/P converter, Atomizer, Compressed air distribution unit, Paint mixing unit, Pumps, Control unit, Pneumatic spray guns,*

***Аннотация.** В данной статье рассматриваются вопросы управления роботами-манипуляторами, используемыми для покраски. Разработаны аппликаторы, схемы управления и алгоритмы, используемые в процессе окраски.*

***Ключевые слова.** Покраска кузовов, Покрасочные роботы, Наружные поверхности, Труднодоступные места, Первые серийные покрасочные роботы, Роботизированная система Trallfa ABB, I/P преобразователь, Распылитель, Блок распределения сжатого воздуха, Блок смешивания краски, Насосы, Блок управления, Пневматические краскопульты,*

It is common practice in the European automotive industry to use conventional automatic spray and bell machines for painting car bodies [1-3]. Painting robots are mainly used for indoor areas, such as interior, engine compartment, trunk, doorways and doorways. In some paint lines, areas on the outer surface of the car that are inaccessible to external machines are subsequently painted by paint robots.

And in 1969, the first serial painting robots came out of the conveyor. Later company Trallfa was purchased by company ABB and it has six products with the best decorative system. Figure 1 shows an example of a robotic robotic system. And the following elements are used in the system: I/P converter, atomizer, compressed air distribution unit, paint mixing unit, pumps and their control unit [4-5].

The trend in the Japanese automotive industry is also towards the use of paint robots to cover exterior surfaces. In Europe, the first company to do this was Peugeot, where pneumatic spray guns apply a second coat of metallic paint.

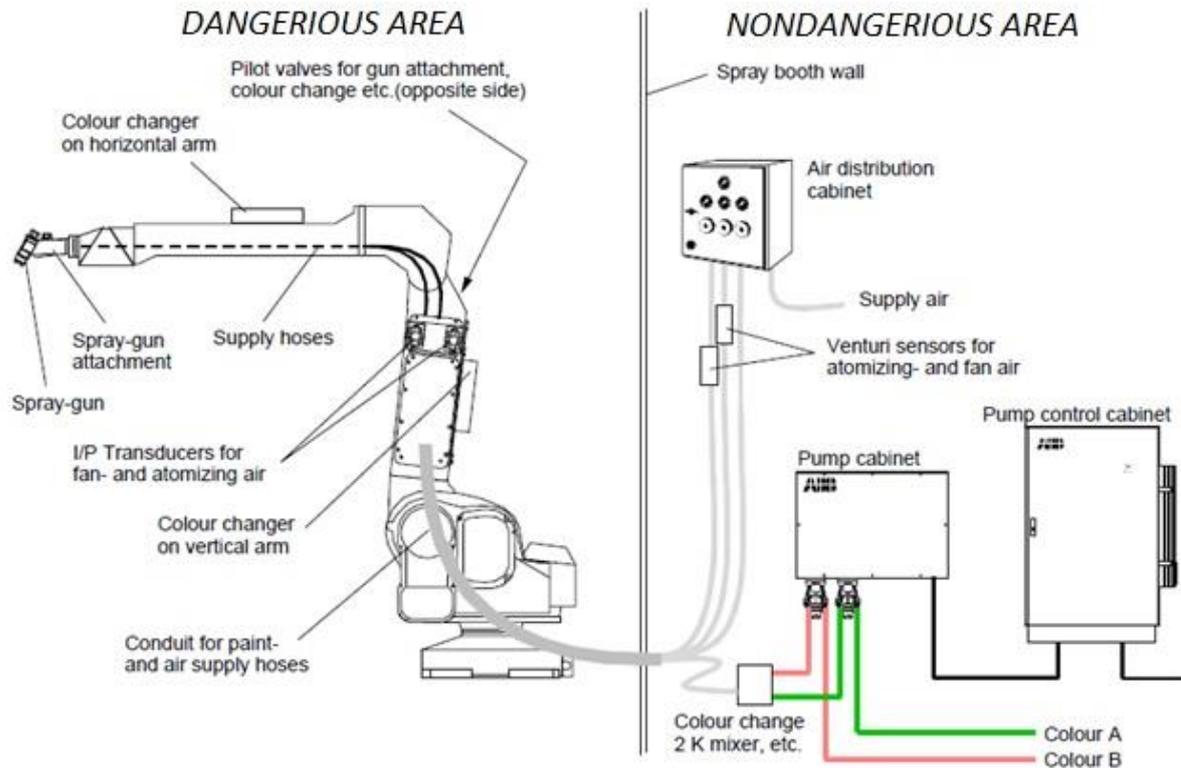


Fig. 1. IPS with pump and robot IRB5400.

Today, there are new signs of an upwards trend, partly due to productivity and quality improvement programmes that are being introduced in the industry. Recent investments at Mercedes-Benz and BMW reflect this situation.

A look at the development of robot technology in the last ten years allows a comparison of several key parameters and shows clearly how the versatility of the machines has improved. Electrically driven paint robots, which operate with much higher availability and require less costly maintenance, are now used exclusively. In addition, the painting speed has been increased by about 50 percent, while the dynamic accuracy of the path tracking and the absolute accuracy (referred to the target coordinates) have also improved (Table 1).

The process of cleaning with an auxiliary sprayer is based on the standard sorting system management [6-8]. The setting of each system affects the final painting process and, in addition, the quality of the paint application. In practice, fine-tuning the painting process by selecting the correct system control parameters is one of the most difficult painting disciplines.

The air management system, which regulates the required air flow and the applicator. A color management system that regulates the desired flow of color to the applicator. The high voltage control system regulates the voltage of the electrostatic applicator.

Integrated Process System (IPS), which governs the entire system, consists of closed control loops. High speed system of control by applicator, precisely synchronized with two robots. The short scheme shows all the systems in the following figure.

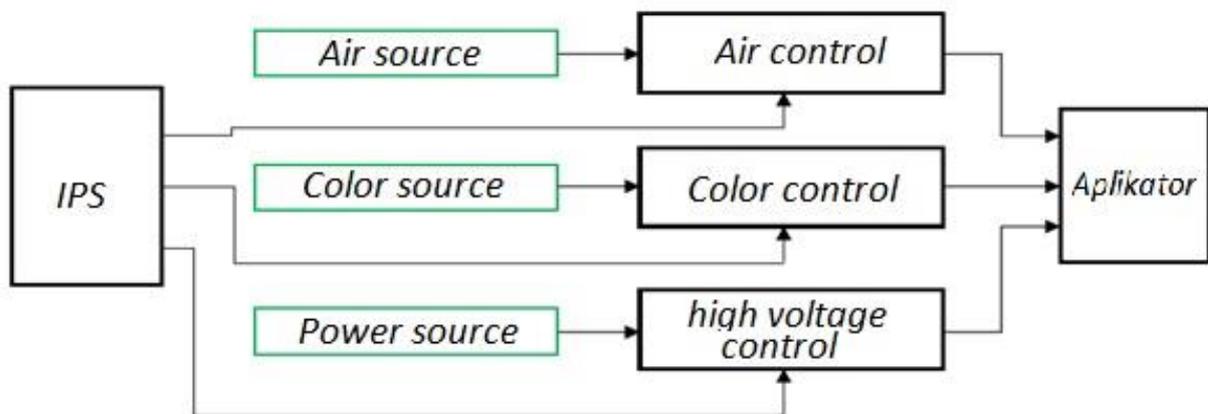


Fig.2. Applicator control scheme.

Air management. The air unit control principle is described for the ABB RB1000 applicator. The air distribution shape is controlled by the air flow for the atomizer (atomizing air) and the air flow for shaping (shaping air). The atomizing air supply is designed to atomize and vaporize the paint. Atomizing air is controlled by an IPS unit with an IP regulator that regulates the flow and pressure of the air entering the paint hood. The forming air is also controlled by the IPS unit. Its main function is to set the desired shape and width of the dye deposition. A simplified diagram is shown in Figure 3.

The Color Changer block is specially designed so that you can change the color very quickly. The internal structure of the inverter is designed without "dead ends", minimizing time and losses during cleaning cycles.

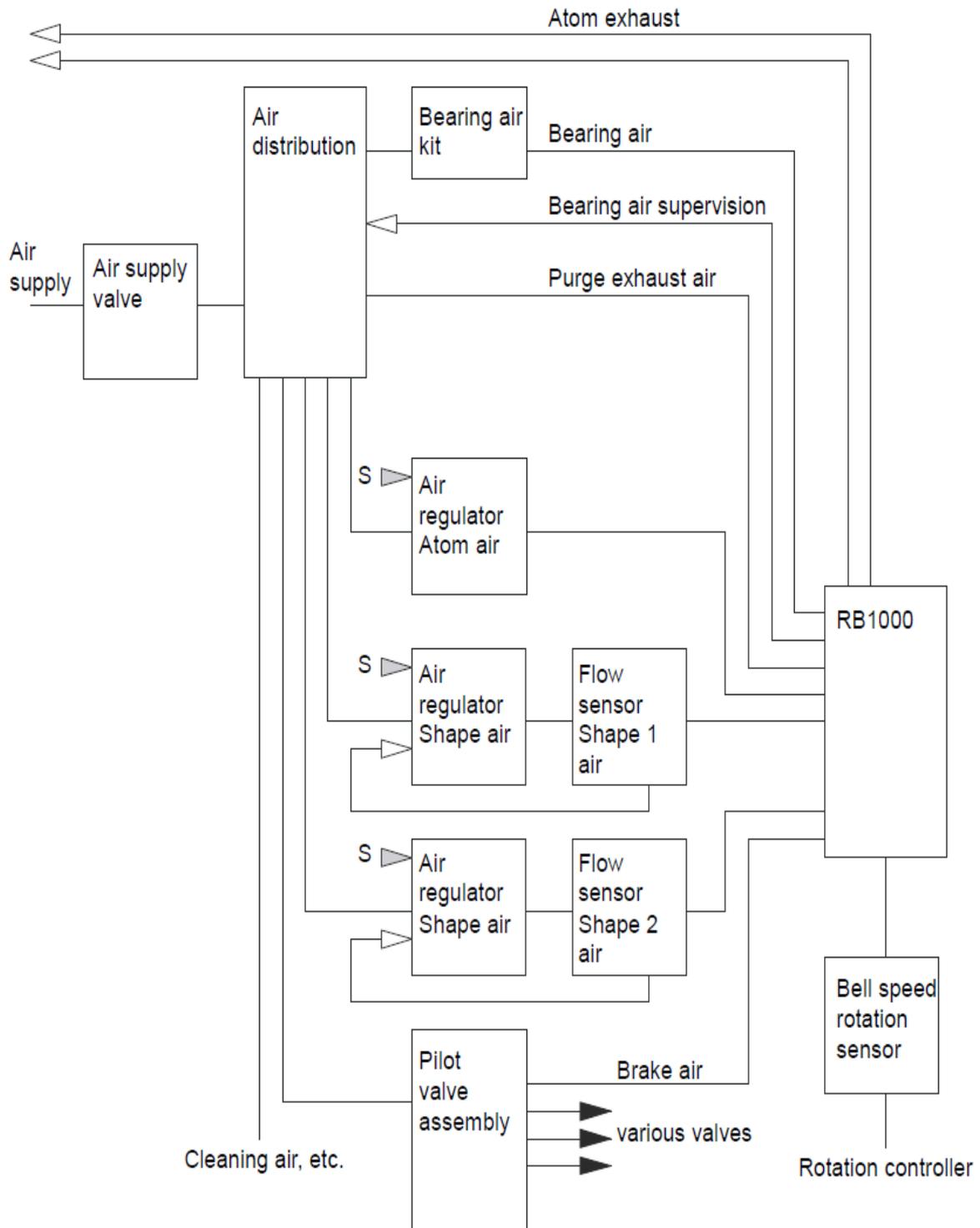


Fig. 3. Flow diagram of the air circuit for RB1000

There are 3 types of nozzles (atomizer) used in robotics. They differ from each other in the technology of transporting paint to the target, the shape of the spray beam, the size of the spray beam, and the purchase price. The simplest type is the atomizer

(Fig. 5. a.) without the formation of air and high voltage. The spray beam width is typically between 30 mm and 350 mm. The shape of the beam depends on both the shape of the nozzle and the distance of the nozzle from the target, and possibly also on the pressure of the medium.

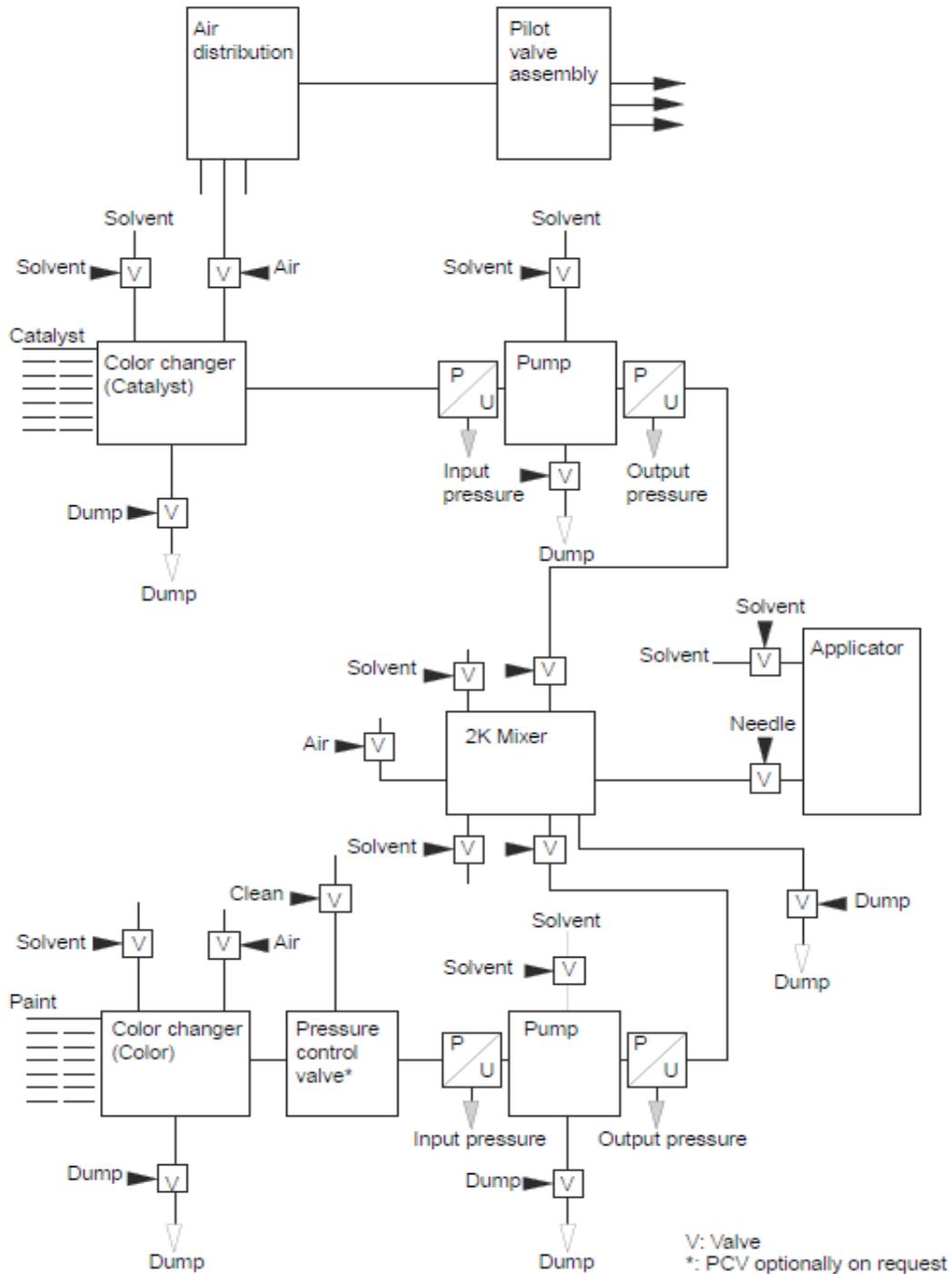


Fig.4. Color scheme for RB1000 using 2K Mixer block

The most commonly used system (Fig. 5. b.), In which shaping air is used to adjust the color. Spray beam width from 50 to 500 mm. The advantage of this system is the ability to change the shape and color distribution by changing the pressure of the shaping air.

In addition, the shape of the spray beam can be influenced by the pressure of the medium and the distance from the nozzle to the target.

The most widespread in robotics are atomizers with a rotating cap (Fig. 5. c.). Their ability to apply paint evenly is commonly used in the automotive industry. The width of the round beam varies from 100 to 500 mm and can be changed by changing many parameters such as voltage, turbine speed, air pressures, etc.

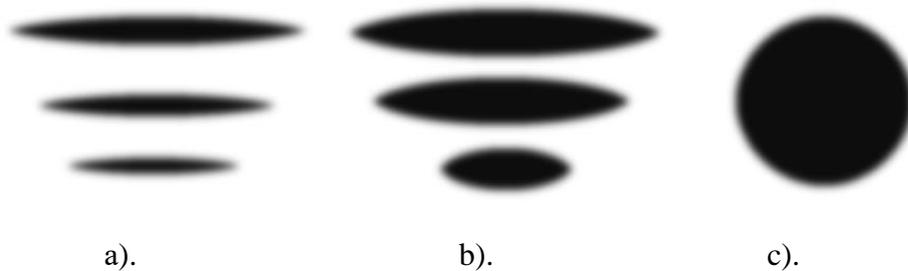


Fig. 5. Three types of spray pattern a) no air generation and no high voltage. b). shaping air is used to adjust the color. c). rotating cap atomizers

Building on the experience with paint systems and modular interfaces, it was possible here, too, to integrate the applications technology in the robot control. The method of application used is of considerable importance for weld sealing, which could be significantly improved as a result. A more accurate nozzle, achieved by working with narrower production tolerances, allows reproducible spray images. In combination with a modified nozzle configuration, this has produced more uniform and flatter surfaces. Pressure control with volume compensation has proved its worth for metering.

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