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**Datasheet for the decision
of 20 May 2021**

Case Number: T 0317/16 - 3.2.07

Application Number: 05257568.5

Publication Number: 1671759

IPC: B25J9/16

Language of the proceedings: EN

Title of invention:

Robot controller and robot control method

Patent Proprietor:

KAWASAKI JUKOGYO KABUSHIKI KAISHA

Opponents:

Siemens Aktiengesellschaft
KUKA Roboter GmbH

Headword:

Relevant legal provisions:

EPC Art. 54, 56, 84, 100(a), 100(b), 108

EPC R. 99(2)

RPBA 2020 Art. 15(1), 12(2), 12(3)

RPBA Art. 12(2)

Keyword:

Claims - clarity (yes)

Novelty - main request (no) - auxiliary request (yes)

Inventive step - auxiliary request (yes)

Decisions cited:

Catchword:



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Case Number: T 0317/16 - 3.2.07

D E C I S I O N
of Technical Board of Appeal 3.2.07
of 20 May 2021

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
27 November 2015 concerning maintenance of the
European Patent No. 1671759 in amended form.**

Composition of the Board:

Chairman I. Beckedorf
Members: V. Bevilacqua
 A. Pieracci

Summary of Facts and Submissions

- I. The appeals of the patent proprietor and of both opponents arise from the interlocutory decision of the opposition division to maintain European patent No. 1 671 759 in amended form on the basis of the then auxiliary request 2" filed during oral proceedings (7 October 2015).
- II. The two oppositions were directed against the patent as a whole and were based on Article 100(a) EPC (lack of novelty and lack of inventive step) as well as Article 100(b) EPC (insufficiency of disclosure).
- III. The patent proprietor (appellant) requested
- that the decision under appeal be set aside
and
that the patent be maintained as granted (main request),
or, in the alternative,
that the patent be maintained in amended form on the basis of one of the sets of claims filed as auxiliary requests 1 to 4 with its statement setting out the grounds of appeal, whereby the set of claims of auxiliary request 2 corresponds to the set of claims on the basis of which the patent was maintained according to the appealed decision (auxiliary request 2").

The opponents requested

that the decision under appeal be set aside
and
that the patent be revoked.

Opponent 2 also requested

that the appeal of the patent proprietor be dismissed.

IV. In the present decision reference will be made to the following documents:

D4: Ulrich Wiest: "Kinematische Kalibrierung von Industrierobotern", Dissertation at the University of Karlsruhe (TH), defended on 11 January 2001 and published on 19 March 2001 by Shaker Verlag with ISBN: 3826586093;

D5: K. Schröer (ed): "Handbook on Robot Performance Testing and Calibration", Fraunhofer IRB Verlag, 1998, ISBN 3-8167-5200-4, pages 171-201;

D6: S.Hesse, "Industrieroboterpraxis", Vieweg-Verlag, 1998, ISBN 3-528-06887-6, pages 155-205;

D9: J.S. Shamma / D.E. Whitney: "A Method for Inverse Robot Calibration", ASME Journal of Dynamic Systems, Measurement and Control, vol. 109, no. 1, March 1987, pages 36-43;

E2: EP 0 289 836 A1.

V. In preparation for oral proceedings scheduled at the request of all parties, the Board communicated its preliminary assessment of the case by means of a communication pursuant to Article 15(1) RPBA 2020.

In this communication the Board indicated its negative preliminary opinion on the appeal of the patent

proprietor, based on the following preliminary assessments:

- that the opposition division correctly established that the subject-matter of claim 11 of the main request lacked novelty over D4 (point 1.1 thereof),
- that the patent proprietor failed to provide reasons to deviate from the conclusions of the opposition division that the subject-matter of claim 5 of auxiliary request 1 (corresponding to auxiliary request 2' in opposition) was not inventive (point 2.1 thereof).

In this communication the Board also indicated its negative preliminary opinion on the appeals of the opponents, giving reasons why they had failed to demonstrate the incorrectness of the decision to maintain the patent according to auxiliary request 2 (point 3 thereof).

- VI. With letter of 15 July 2020 the patent proprietor responded to the communication pursuant to Article 15(1) RPBA 2020 explaining that the arguments provided in support of claim 5 of the main request equally applied to claim 5 of auxiliary request 1.
- VII. With letter of 20 April 2021 opponent 1 responded to the communication pursuant to Article 15(1) RPBA 2020 by further developing its previous patentability objections based on E2 and D4, raised against the main request and against auxiliary requests 1 and 2.
- VIII. With letter of 10 May 2021 the patent proprietor reacted to the above submission of opponent 1 requesting the non-admission of a new line of

argumentation allegedly contained therein, and by submitting further arguments in support of claim 1 of the main request.

- IX. Oral proceedings before the Board took place on 20 May 2021. At the conclusion thereof the decision was announced. Further details of the proceedings can be found in the minutes thereof.
- X. The lines of argument of the parties are dealt with in detail in the reasons for the decision.
- XI. The parties' final requests correspond to their initial requests (see point III. above).
- XII. Independent claim 11 of the patent as granted (main request) reads:

"A robot control method of controlling a robot including a robot arm having a free end, and drive shafts, comprising:
a forward conversion step of converting angular displacements by which the drive shafts are to be turned into position-attitude data indicating a position of the free end of the robot arm and an attitude of the robot in a rectangular coordinate system through a forward conversion;
a correcting step of correcting the position-attitude data obtained in the forward conversion step based on inherent errors in the robot;
an inverse conversion step of converting the position-attitude data corrected by the correcting step into angular displacements through an inverse conversion;
and

an instructing step of instructing the robot of the angular displacements obtained through the inverse conversion in the inverse conversion step."

Independent claim 5 of auxiliary request 1 reads:

"A robot controller for controlling a robot including a robot arm having a free end, and drive shafts, comprising:

input means for entering angular displacements by which the drive shafts of the robot arm are to be turned and position-attitude data indicating a position of the free end of the robot arm and an attitude of the robot in a rectangular coordinate system;

correcting means for correcting the position-attitude data entered by the input means based on inherent errors in the robot;

inverse conversion means for converting corrected position-attitude data corrected by the correcting means into angular displacements through an inverse conversion;

and

instructing means for selecting either the angular displacements entered by the input means or the angular displacements obtained through the inverse conversion by the inverse conversion means in accordance with a predetermined condition and instructing the robot of selected angular displacements,

wherein the inverse conversion means is configured to carry out the inverse conversion based on the assumption that the robot is an ideal robot not having any errors at all and any correction is not necessary."

Independent claim 1 of auxiliary request 2, held by the opposition division to meet the requirements of the EPC, reads:

"A robot controller for controlling a robot including a robot arm having a free end, and drive shafts, comprising:

input means for entering angular displacements by which drive shafts of the robot arm are to be turned;

forward conversion means for converting the angular displacements entered by the input means into position-attitude data indicating a position of the free end of the robot arm and an attitude of the robot in a rectangular coordinate system through a forward conversion;

correcting means for correcting the position-attitude data provided by the forward conversion means based on inherent errors in the robot;

inverse conversion means for converting corrected position-attitude data corrected by the correcting means into corrected angular displacements through an inverse conversion; and

instructing means for instructing the robot of the corrected angular displacements provided by the inverse conversion means,

wherein the forward conversion means and the inverse conversion means are configured to carry out the forward and inverse conversion based on the assumption that the robot is an ideal robot not having any errors at all and any correction is not necessary, respectively."

Independent claim 5 of said request reads:

"A robot control method of controlling a robot including a robot arm having a free end, and drive shafts, comprising:

a forward conversion step of converting angular displacements entered via input means by which the

drive shafts are to be turned into position-attitude data indicating a position of the free end of the robot arm and an attitude of the robot in a rectangular coordinate system through a forward conversion; a correcting step of correcting the position-attitude data obtained in the forward conversion step based on inherent errors in the robot; an inverse conversion step of converting the position-attitude data corrected by the correcting step into angular displacements through an inverse conversion; and an instructing step of instructing the robot of the angular displacements obtained through the inverse conversion in the inverse conversion step, wherein the forward and inverse conversion is carried out based on the assumption that the robot is an ideal robot not having any errors at all and any correction is not necessary, respectively."

Reasons for the Decision

1. Main request, claim 11 - Lack of novelty - Articles 100(a) and 54 EPC
- 1.1 According to the appealed decision (points 5.1 and 5.1.4 of the grounds for the decision under appeal) the subject-matter of claim 11 of the main request lacked novelty over the content of the disclosure of D4.
- 1.1.1 The patent proprietor argued that the above assessment of lack of novelty was based on an excessively broad interpretation of the features "forward conversion" and "inverse conversion".

These conversions, on a proper construction of claim 1, which should be based on paragraphs [0068] and [0069] of the patent specification, were only to be done on ideal, non-calibrated robot parameters, and not on calibrated ones, as disclosed in D4.

This was also evident from the rest of the claim, according to which the correcting step was carried out by the correcting means, so that the forward/inverse conversion did not need to include any further correction.

1.2 The Board disagrees.

The embodiments described in paragraphs [0068] and [0069] of the patent specification, to which the patent proprietor refers in its argumentation to show that conversions are done only on the non-corrected, ideal robot parameters, relate to a specific embodiment, based on a robot controller (depicted in figure 4) performing forward and inverse conversions under the assumption that the robot is an ideal robot.

However, according to paragraph [0065] of the patent specification, a forward conversion is "a" (and therefore any) procedure for determining the cartesian coordinates of the free end of a robot arm from the angular displacements of the drive shafts of the robot arm.

An inverse conversion is (see again paragraph [0065] of the patent in suit) "a" procedure for determining the angular displacements of the drive shafts of a robot arm from the cartesian coordinates of the free end of the robot arm.

These definitions are not given, in the patent in suit, under the assumption or condition that the robot is an ideal robot and that the parameters are ideal, non-calibrated robot parameters.

This leads the Board to conclude that there is no reason to consider that a skilled person would exclude that forward and inverse conversions are done on corrected robot parameters.

The rather restrictive interpretation proposed by the patent proprietor therefore would not be chosen by a skilled reader of claim 11 of the main request.

As established in the case law (see Case Law of the Boards of Appeal [CLB], 9th edition 2019, II.A.6.1), a broad term used in a claim is not to be construed narrowly, even if, as in the case at issue, the narrower interpretation would refer to a structure which is common (see figure 4 of the patent in suit), but not exclusive, in the technical field concerned.

Reading a broadly formulated claim only technically illogical interpretations should be excluded.

- 1.3 Claim 11 was also novel over D4, so the patent proprietor, because it implicitly contained the feature "input means for entering angular displacements".

This was because the formulation "a forward conversion step of converting angular displacements by which the drive shafts are to be turned" implied that the angular displacements had to be entered with the intention of the operator to turn the drive shafts accordingly.

- 1.4 The Board disagrees again. The presence of "drive shafts" does not necessarily imply that also "input means for entering angular displacements" are present.

As noted by opponent 2, a particular drive shaft can, in a robot, be rotated independently from the intention of the operator to turn this particular drive shaft.

This may happen, for example, as an automatic reaction to the presence of an obstacle (see paragraph [0011] of the patent in suit). In such a case, no input means for entering angular displacement would be needed.

- 1.5 As a consequence, the patent proprietor did not convincingly demonstrate that the opposition division was wrong in establishing that the subject-matter of claim 11 of the main request lacks novelty over the content of the disclosure of D4.

2. Auxiliary request 1

- 2.1 According to Article 12(2) and (3) RPBA 2020 and Article 12 (2) RPBA 2007 in combination with Article 108 EPC and Rule 99(2) EPC, an appealing party should direct its appeal to the requests, facts, objections, arguments and evidence on which the decision under appeal was based.

The statement of grounds of appeal should set out clearly and precisely the reasons why it is requested that the decision under appeal be reversed, amended or upheld, and should specify expressly all the requests, facts, objections, arguments and evidence relied on.

- 2.2 Auxiliary request 2' in opposition, corresponding to the present auxiliary request 1 (see page 6 last sentence of the statement setting out the patent

proprietor's grounds of appeal) was not allowed because the subject-matter of its independent claim 5 was found to lack inventive step in view of the teaching of document D4 and the common general knowledge, as exemplified by document D5 (see point 11 of the grounds for the decision under appeal).

- 2.3 The patent proprietor, being aware of this objection (see also point C.III of the statement setting out the grounds of appeal), failed to explain in its statement setting out the grounds for appeal why the inventive step analysis done by the opposition division was wrong (see in particular pages 6 and 7, where auxiliary request 1 is discussed but inventive step of claim 5 is not dealt with at all).

The patent proprietor also failed to address this issue in its reply to the appeals of the opponents (letter dated 5 August 2015), where auxiliary request 1 is not even named.

- 2.4 Accordingly, the Board informed the patent proprietor that it did not see any reason to deviate from the conclusions of the opposition division that the subject-matter of claim 5 is not inventive (see the communication pursuant to Article 15(1) RPBA 2020, point 2).

- 2.5 The patent proprietor reacted (letter of 15 July 2020) by requesting that the arguments formulated under section A.II of the statement setting out the grounds for appeal in support of claim 5 of the main request be also considered as applying to claim 5 of auxiliary request 1.

2.6 The Board notes the following.

Claim 5 of the present auxiliary request 1 was not allowed because of a lack inventive step assessed starting from D4 and taking into account the knowledge of a skilled person as exemplified by document D5 (points 11 and 11.1 of the reasons of the decision under appeal; point 2 of the Board's communication pursuant to Article 15(1) RPBA 2020).

The opposition division acknowledged the presence of two distinguishing features, justified the absence of a synergetic effect between them, and explained, on the basis of the partial problems approach, why each of the distinguishing features was obvious in view of the knowledge of a skilled person (see in particular point 6.2 of the decision).

The arguments on page 6 of the statement setting out the patent proprietor's grounds of appeal, to which the patent proprietor now refers, are not suitable to show that the appealed decision is not correct.

This is because they do not address the lack of inventive step assessment done by the opposition division, as it is particularly evident from the fact that the issue of the presence/absence of a synergetic effect is not discussed therein (see in particular page 4, starting from the second paragraph).

2.7 The Board therefore concludes that, even when taking into account the arguments provided under section A.II of the statement setting out the grounds for appeal in support of claim 5 of the main request, the substantiation of the patent proprietor's appeal case in respect of the opposition division's finding that

the subject-matter of claim 5 of auxiliary request 1 is missing.

As a consequence of the above, in the absence of any substantiated submission from the patent proprietor the Board sees no reason why the reasoned finding of the opposition division set out in point 11 of the reasons for the decision under appeal could and should be considered incorrect, so that there is no basis for the Board to deviate from the conclusions of the appealed decision on auxiliary request 1.

3. Conclusions on the appeal of the patent proprietor

The patent proprietor's appeal directed to maintaining the patent either as granted or in amended form on the basis of auxiliary request 1 cannot be allowed.

4. Auxiliary request 2

4.1 Clarity - Article 84 EPC

4.1.1 Claims 1 and 5 of auxiliary request 2, corresponding to the version of the patent held by the opposition division in the decision under appeal to meet the requirements of the EPC (then auxiliary request 2'') lacked clarity, so opponent 2, because the expressions "ideal robot" and "not having any errors at all" were both unclear and for this very reason could not mutually clarify each other.

The interpretation of these features at the basis of the appealed decision was arbitrary and not supported by objective criteria.

When presenting the above objection during oral proceedings the opponent 02 explained that the expressions "ideal robot" and "errors" did not have an universally recognized meaning in the field of robotics, and referred in particular to D4, point 3.1, where a "cinematic model" was discussed, and no "ideal robot" was mentioned.

A skilled reader was therefore not in the position to understand if the claimed "ideal robot" was to be considered as a robot model free only from the so called "geometrical errors" (see D4, page 29, point 3.4), or only from the so called "non geometrical errors" (D4, point 3.5) or from both.

Based on that, lack of clarity was evident because a skilled reader was not in the position of being able to understand if he was working in the protected area of the claims or not.

- 4.1.2 The Board disagrees. The appealed decision is based on the assumption that (see point 9.2 of the grounds) an "ideal robot" is a purely geometrical model, not having any errors at all, done by modelling the major elements of the mechanical frame of the robot as mathematical vectors.

The objection of opponent 02 is on the contrary based on the allegation that a model taking into account the elastic deformations of the mechanical frame of the robot ("non-geometrical errors"), but not the "geometrical errors" identified in D4, would also be considered by a skilled person as an "ideal robot".

As however D4, to which opponent 02 refers, does not discuss what an "ideal robot" is, the opponent 02

failed to provide convincing proof of the above allegation.

Thus, the Board sees no reason to deviate from the interpretation of the appealed decision, supported by the patent proprietor (point 2.1 of the letter dated 5 August 2016), that it is common practice to describe the behaviour of a robot with an abstract, purely geometrical model, identifiable as an "ideal robot", and to then, if necessary for a particular application, measure and eventually correct deviations between the nominal (calculated) and the observed position and attitude of the robot.

This can be derived from E2, page 2, lines 8-25, but also from D4, Chapter 1, as well as paragraphs [002]-[005] of the patent in suit).

As a consequence of the above, the Board sees no reason to deviate, on the basis of the arguments of opponent 2, from the conclusions on clarity reached under point 9.2 of the grounds for the appealed decision.

4.2 Novelty over E2 - Article 54 EPC

4.2.1 Opponent 2 argues that E2 discloses all the features of independent claims 1 and 5 of auxiliary request 2. The findings of the opposition division to the contrary in point 10.3 of the grounds for the appealed decision was therefore not correct.

This was in particular because, as argued by opponent 02 during oral proceedings, the claims did not specify any particular coordinate system for the position-attitude data.

As the claims are formulated in such a way that the coordinate system for the position-attitude data can be chosen freely, the vector Δx (E2, see figure 1) was to be considered as corresponding to the claimed position-attitude data, and all the remaining features of the claims were derivable from the flow chart (figure 3) of E2 and the corresponding passages of the description (starting from line 13 of page 5).

- 4.2.2 The Board is not convinced on the basis of the above argumentation that the opposition division wrongly established that E2 is not novelty destroying.

This is because, once Δx is seen as corresponding to the claimed position-attitude data, E2 fails to disclose a correction thereof, but rather discloses the calculation of corrected angular data based on Δx (step III of figure 3, page 5, last three lines).

The Board is therefore not convinced, on the basis of the arguments provided by opponent 02, that the opposition division wrongly assessed novelty of claims 1 and 5 of auxiliary request 2.

- 4.3 Inventive step, starting from D4 - Article 56 EPC

- 4.3.1 The opponents put forward that the subject-matter of claims 1 and 5 lacks inventive step starting from D4, when the teaching of D6 is taken into account. Inventive step objection based on D4 were also raised taking the teachings of D5 (see the last paragraph at page 4 of the letter dated 22 August 2016 of opponent 2) and D9 (see in particular point 6.8.5 of the statement setting out the grounds of appeal of opponent 2) into account.

The opponents acknowledge that the subject matter of claims 1 and 5 differs from the method and controller according to D4 by the input means of angle data, since, according to D4, cartesian data were entered (decision 5.1.2).

The problem to be solved was therefore to use the method or software package described in D4 with angle data instead of cartesian position data.

Inventive step should be denied because the specification of target (axis) angle data and of (cartesian) target position data are the only two alternatives in robotics, as shown in particular by D6 (page 193, but reference was also made to D5 page 178 and D9, page 37, figure 3), where both cartesian position data ("downward Z-axis") and angle data ("C-axis swivel") are entered.

The solution according to claims 1 and 5 was also obvious in view of the knowledge of a skilled person because no source code for the controller according to D4 being readily available, a skilled person would have treated the software of D4 as a "black box" by adding a new software module upstream thereof, to convert the angular data into cartesian data as a first step.

Such a software module would perform a standard forward transformation of the available angle data into the cartesian system, then used by the software of D4.

In this way the skilled person would arrive at the subject-matter of claims 1 and 5 of auxiliary request 2 without having to exercise any inventive skill.

4.3.2 The opponents also argued at oral proceedings (see also the letter of opponent 1 dated 20 April 2021, and in particular the second paragraph at page 6 in combination with the passage spanning pages 9 and 10), that the only difference between the subject-matter of independent claims 1 and 5 of auxiliary request 2 and the method and controller disclosed in D4 was that D4 discloses the same steps (and in particular forward and inverse conversions) listed in these claims, but in an inverted sequence.

Starting from the method and controller of D4, using angular data, it would be possible and obvious, for a skilled person to invert the order of the calculation steps disclosed in this document, if and when the circumstances of a particular application would require starting from angular data.

4.3.3 The Board is not convinced by the above inventive step objections.

As noted by the patent proprietor, a skilled person aimed at improving the positional accuracy of a robot controller (and a method) starting from angular data would not have considered the software package described in D4 as a suitable starting point, because this software package requires cartesian input data.

Contrary to what has been argued by the opponents, a skilled person is not aimed, in this particular technical field, at unnecessarily increasing the amount and complexity of the calculations needed for controlling a robot, and adding an additional software module upstream of the one disclosed in D4, which first converts the angle data into position data, would clearly increase the complexity of the calculations,

without providing any improvement in the positional accuracy of the robot.

The Board also concurs with the opposition division (see point 11.2.3, third paragraph of the Grounds for the decision) that starting from the method and controller disclosed in D4, the skilled person would have rather skipped the first inverse conversion shown in Fig. 3.9 of D4 to directly carry out the modified forward conversion.

By doing that the skilled person would have however arrived at a controller and a method which are different from those of claims 1 and 5 of auxiliary request 2.

As the above discussion shows, the Board is not convinced that the opposition division wrongly concluded that the subject-matter of claims 1 and 5 of auxiliary request 2 involved an inventive step starting from D4 (see points 11.1-11.4 of the appealed decision).

4.3.4 In the light of the Board's conclusion that the above inventive step objections were not convincing, there was no need to formally decide on the patent proprietor's admissibility objection raised against the alleged amendments made by the opponents to their respective appeal cases.

4.4 Inventive step, starting from E2 - Article 56 EPC

4.4.1 Starting from E2 it would also be possible and therefore obvious, for a skilled person, so the opponents, to arrive at the subject-matter of independent claims 1 and 5 of auxiliary request 2.

This was because, in analogy with what has already been discussed in relation to D4 (see also the last paragraph at page 7 and the first two paragraphs at page 8 of the letter dated 20 April 2021) the only difference between the subject-matter of independent claims 1 and 5 of auxiliary request 2 and the method and controller disclosed in E2 was that E2 disclosed the same steps in an inverted sequence, such that it would be possible by simply inverting the known sequence of conversions, to arrive at the claimed method and controller.

- 4.4.2 The Board is not convinced by the above objection because (see the CLB, *supra*, I.D.5) when considering if claimed subject-matter involves an inventive step or not, the question to be answered is whether or not the skilled person, in the expectation of solving a particular technical problem, would have modified the teaching of a specific prior art document (such as E2 in the present case) in the light of a teaching derivable from the prior art so as to arrive at the claimed invention.

So the crucial point is not the one addressed by opponent 01, who argued that the skilled person **could** have arrived at the invention by modifying the method and controller disclosed in E2, but rather whether, in expectation of the advantages actually achieved (i.e. in the light of the technical problem addressed), he **would** have found a hint in the prior art to do so.

As a consequence of the above, opponent 01 failed to convincingly demonstrate that the inventive step assessment done by the opposition division was not correct.

5. Conclusions on the appeals of the opponents

The Board concludes that the opponents failed to submit convincing arguments to show that the claims of auxiliary request 2 lack clarity, novelty and inventive step.

The objections raised by opponent 2 under Articles 83, 107 and 123(2) EPC during the written proceedings (points 3.1, 3.3 and 3.4 of the Board's communication pursuant to Article 15(1) RPBA 2020), were withdrawn during oral proceeding (see the minutes thereof, page 5, last two sentences, according to which opponent 2, when asked by the Chairman, did not maintain these objection, and both opponents confirmed that they had no further objections against the maintained version than those which were presented and discussed orally).

Thus, the appeals of the opponents aimed at the revocation of the patent in suit in the version held by the opposition division in the decision under appeal to meet the requirements of the EPC cannot be allowed.

Order

For these reasons it is decided that:

The appeals of the patent proprietor, of opponent 01
and of opponent 02 are dismissed.

The Registrar:

The Chairman:



G. Nachtigall

I. Beckedorf

Decision electronically authenticated