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Applicant:
OMRON CORPORATION

Headword:
Signal-processing device/OMRON

Relevant legal provisions:
EPC Art. 56
RPBA 2020 Art. 13(2)

Keyword:
Inventive step - main request and 1st to 5th auxiliary requests (no)
Admittance of claim amendments filed after Art. 15(1) RPBA communication - 6th auxiliary request (no)

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Case Number: T 1188/23 - 3.5.05

D E C I S I O N
of Technical Board of Appeal 3.5.05
of 8 April 2024

Appellant: (Applicant)	OMRON CORPORATION 801, Minamifudodo-cho, Horikawahigashiiru, Shiokoji-dori, Shimogyo-ku, Kyoto-shi, Kyoto 600-8530 (JP)
Representative:	Becker Kurig & Partner Patentanwälte mbB Bavariastraße 7 80336 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 9 January 2023 refusing European patent application No. 16204061.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chair	K. Bengi-Akyürek
Members:	K. Schenkel
	C. Almberg

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division to refuse the present European patent application. Claim 1 of a main request was found to lack an inventive step (Article 56 EPC) having regard to the following prior-art document:

D8: EP 2 003 525 A2.

The first to third auxiliary requests were not admitted into the proceedings on the grounds that they *prima facie* lacked clarity or contained added subject-matter.

II. Oral proceedings were held before the board on 8 April 2024.

The appellant's final requests were that the appealed decision be set aside and that a patent be granted based on the claims of a **main request** or one of **six auxiliary requests**, of which the sixth auxiliary request was first filed with the written response to the board's communication under Article 15(1) RPBA.

At the end of the oral proceedings, the board's decision was announced.

III. Claim 1 of the **main request** reads as follows (board's labelling):

(a) "A master-slave control system (1), comprising:
(b) a plurality of sensors (120);
(c) a control device (20); and
(d) a plurality of signal processing devices (110), connected with the control device (20) via a

network, each of the signal processing devices (110) processes an analog signal from the corresponding sensor (120) and forwarding the signal to the control device (20), each of the signal processing devices (110) comprises:

(e) an acquisition element (112), which is an A/D converter, that acquires the signal from the corresponding sensor (120) with a specified data acquisition cycle, thereby generating time sequence data; the master-slave control system (1) being characterized in that each of the signal processing devices (110) further comprises:

(f) a noise removal element (113) that removes frequency noise in a frequency range corresponding to the data acquisition cycle from the time sequence data, wherein the data acquisition cycle is a sampling cycle of converting the analog signal to a digital signal by the A/D converter; and

(g) a forwarding element (115) that periodically forwards the time sequence data, from which the frequency noise is removed via the noise removal element (113), to the control device (20) with a specified forwarding cycle,

(h) the data acquisition cycle is shorter than the forwarding cycle, wherein

(i) the control device (20) is a master device in the master-slave control system (1), the master-slave control system (1) comprising the master device and one or more than one slave device connected with the master device via the network,

(j) at least one slave device of the one or more than one slave devices comprises the plurality of the signal processing devices (110) that synchronize the data acquisition cycles with each other, and

(k) the forwarding cycle of each of the signal processing devices (110) is synchronous with a control cycle of the master device,
(l) the forwarding cycle is an integer multiple of two or more than two of the data acquisition cycle."

IV. Claim 1 of the **first auxiliary request** differs from claim 1 of the main request in that the wording of features (f) and (k) here reads as follows (board's labelling and underlining of added text):

(f') "a noise removal element (113) that performs digital filtering on the time sequence data to remove frequency noise in a frequency range corresponding to the data acquisition cycle from the time sequence data, wherein the data acquisition cycle is a sampling cycle of converting the analog signal to a digital signal by the A/D converter; and"

(k') "the forwarding cycle of each of the signal processing devices (110) is synchronous with a control cycle of the master device, wherein a period from a starting of previous output refresh of the control device (20) to a starting of next output refresh of the control device (20) is calculated as the control cycle of the master device,

and in that, at the end, the following wording has been added (board's labelling):

(m) "wherein the corresponding sensor (120) is a load cell".

V. Claim 1 of the **second auxiliary request** differs from claim 1 of the first auxiliary request in that, at the end, the following wording has been added (board's labelling):

(n) "and in each of the signal processing devices (110), the data acquisition cycle is shorter than the control cycle of the master device".

VI. Claim 1 of the **third auxiliary request** differs from claim 1 of the main request in that the wording of features (a) and (b) here reads as follows (board's labelling and underlining of added text):

(a') "A master-slave control system (1) adapted for control of a multi-axis control system including a plurality of control objects, comprising:" and

(b') "a plurality of sensors (120) each configured to detect a state value of one of the plurality of control objects and output an analog signal corresponding to the detected state value;".

VII. Claim 1 of the **fourth auxiliary request** differs from claim 1 of the first auxiliary request in that the wording of feature (f') here reads as follows (board's labelling and underlining of added text):

(f'') a noise removal element (113) that performs digital filtering on the time sequence data to remove frequency noise in a frequency range depending on the data acquisition cycle from the time sequence data, wherein the data acquisition

cycle is a sampling cycle of converting the analog signal to a digital signal by the A/D converter; and"

VIII. Claim 1 of the **fifth auxiliary request** differs from claim 1 of the fourth auxiliary request in that, at the end, the wording of feature (n) has been added.

IX. Claim 1 of the **sixth auxiliary request** differs from claim 1 of the third auxiliary request in that the wording of feature (f) here reads as follows (board's labelling and underlining of added text):

(f''') a noise removal element (113) that removes, corresponding to the data acquisition cycle, frequency noise from the time sequence data, wherein the data acquisition cycle is a sampling cycle of converting the analog signal to a digital signal by the A/D converter; and"

and that, at the end, the following wording has been added (board's labelling):

(o) "a timing of acquiring of the state values from the control objects is synchronized with a timing of updating output values for the control objects between the plurality of sensors (120)".

Reasons for the Decision

1. Main request - inventive step (Article 56 EPC)

1.1 Background of the invention

The present invention relates to a "data acquisition system" with a "control device" and multiple "signal processing devices", each of the latter comprising an "A/D-converter" for sampling data according to a "data acquisition cycle", a "noise removal element" and a "forwarding element" for forwarding the data to the control device according to a "forwarding cycle". Furthermore, the "data acquisition cycle" is shorter than the forwarding cycle.

1.2 Construction of feature (f)

The appellant argued that the term "corresponding" used in the expression "removes frequency noise in a frequency range corresponding to the data acquisition cycle" in feature (f) linked the removing of frequency noise to the data acquisition cycle and not the "frequency noise". With reference to Figure 3 of the present application, it was explained that with every "data acquisition step 8" noise was removed and that four data acquisition steps 8 corresponded to one control cycle. The "frequency range" of the removed noise was not further specified.

The board took note of this construction and concludes that feature (f) allows the aforementioned understanding but does not exclude the other possibility, namely that it is the "frequency range" which corresponds to the "data acquisition cycle".

1.3 Prior-art document **D8** also discloses a "data acquisition system".

1.3.1 Regarding **feature (a) to (d)**, document D8 discloses a control system ("industrial control I/O system", claim 1), in which a signal processing device ("I/O

module") acquires data from a component of an industrial process, which implies the presence of sensors, stores them and produces them en bloc ("entire contents of the I/O internal memory") to a control device ("industrial controller", paragraph [0023]). The signal processing device is polled by the control device which can be considered therefore the master (paragraph [0010]). The system may include multiple signal processing devices which are connected via an adapter module 12 and a network 16 to the control system (paragraph [0026]; Figs. 3 and 4).

1.3.2 As to **feature (e)**, each signal processing device ("I/O module") comprises an acquisition element, which is an A/D converter and samples the component of the industrial process with a data acquisition rate ("sampling rate 1", paragraphs [0023] and [0028]).

1.3.3 As to **features (g) and (k)**, providing the data to the control device ("industrial controller") implies a forwarding element of the signal-processing device and occurs at a forwarding cycle ("polling rate 2") which is also synchronous with the control cycle of the control device (paragraph [0024]: "The industrial controller processes the produced data at a polling rate 2 representative of its internal data processing scan").

1.3.4 As to **feature (h)**, the appellant argued that, contrary to the findings in the appealed decision, D8 and in particular paragraph [0001] did not disclose that the forwarding cycle is synchronous with a control cycle of the master device.

The board disagrees. The wording "control cycle" is broad and may refer to the cycle of polling the I/O

modules in which case the forwarding cycle is identical and necessarily synchronous with the control cycle of the master device. Furthermore, paragraph [0024] discloses that the polling rate 2, which is equivalent to the "forwarding cycle", is representative of the "internal processing scan" of the control device, which certainly can be considered a control cycle of the control device, and thus synchronous with it. Moreover, the data acquisition cycle is shorter than the forwarding cycle (claim 4: "... sampling rate is faster than the processing rate, either the polling rate in a polled system or ...").

1.3.5 As to **features (i) and (j)**, the plurality of I/O modules 20 in the I/O system 10 can be considered to form a slave that is connected to the master device ("industrial controller") via the network ("adapter module 12" and "network 16"; paragraphs [0026] and [0027], Figs. 3 and 4). Further, each signal-processing device ("I/O module") is synchronised with a master clock of the control system ("industrial control I/O system") and with other signal-processing devices (paragraph [0035]).

1.3.6 As to **feature (l)**, the "data acquisition cycle" may be 400µs and the "forwarding cycle" may be 8ms which is an integer multiple ≥2 of the data acquisition cycle (see claims 6 to 8). Hence, contrary to the appellant's argument, also feature (l) is disclosed.

1.4 In sum, the control system of claim 1 differs from the control system of D8, as found by the examining division, in that it includes the noise removal element according to feature (f).

1.5 If "corresponding" is understood as referring to the "frequency range", the technical effect of feature (f) is to remove noise from the digital signal in the frequency range which includes meaningful data considering the Nyquist criterion.

1.6 If "corresponding" is understood as referring to the rate of noise removed as argued by the appellant, the technical effect is that the noise is removed at an earlier stage when the data is gathered, i.e. each sampling cycle.

1.7 Based on the first technical effect as formulated in point 1.5 above, the objective technical problem underlying the invention may be seen as "how to increase the precision of the time sequence data after the noise has been removed in the system of D8". The board does not agree with the objective problem stated in the appealed decision ("how to remove wide range noise without delay", see Reasons 19) and as formulated by the appellant, because, on the one hand, "removing noise points" would already point to the solution and, on the other hand, feature (f) does not necessarily reduce a delay.

1.8 It was common general knowledge in the field of signal processing that signal noise is detrimental to the proper functioning of a signal-processing device and can be removed either by an *analog* filter before or by a *digital* filter after the analog-digital-conversion and that the analog-digital-conversion itself adds quantisation noise. Carrying out such filtering right *after* the A/D converter before forwarding the signal would thus have been a simple implementation choice for the skilled person which did not contribute to an inventive step either.

Hence, the skilled person starting out from D8, faced with the above-mentioned problem, and applying their common general knowledge would have readily considered filtering the digital signal at the signal-processing device for removing noise in order to increase the signal quality. Thus, the skilled person would have indeed arrived at a system according to claim 1 without exercising inventive skill. Moreover, the board does not concur with the reasons given in the appealed decision since the mentioned "anti-aliasing filtering" is applied to the analog signal before the analog-digital-conversion as also expressed in paragraph [0033] of D8, whereas in claim 1 the noise removal or filtering is applied to the digital signal after the analog-digital-conversion.

1.9 For the sake of completeness, it is noted that, even when following the appellant's understanding of feature (f), no inventive contribution could be assigned this feature. This is because removing the noise at other points in time does not change *per se* the forwarded time sequence data, nor does it allow other noise removal procedures. The possible data basis for removing the noise in the time sequence data is formed by the time sequence data received within the forwarding cycle independent of when the noise removal step is actually performed. The only difference thus lies in the allocation of the noise removing task in time. However, it would have been within the common general knowledge of the skilled person to shift data processing tasks if necessary or desired.

1.10 Hence, the main request is not allowable under Article 56 EPC.

2. First to fifth auxiliary requests - inventive step

2.1 Contribution to an inventive step

2.1.1 **Feature (a')** only specifies the use of the claimed "data acquisition system" in a multi-axis control system which does not provide any synergistic or surprising effect. Rather, it would have been common general knowledge to consider this application all the more if multi-axis control systems required a particularly synchronous data acquisition, as stated in the present description, since in the claimed system (and the one of D8) the "signal-processing devices" are synchronised.

2.1.2 **Feature (b')** only further states *expressis verbis* the usual use of the sensors, which is to detect the state of objects, and does not add any further technical limitation beyond the implicit use of the plurality of sensors.

2.1.3 **Feature (f')** only adds to feature (f) the limitation that the noise is removed by means of digital filtering. To remove noise by means of a filter belonged to common general knowledge in the field of signal processing at the application's priority date. Since the noise is removed from the digital signal after the analog-digital-conversion the filter is necessarily a digital filter.

2.1.4 **Feature (f'')** differs from feature (f') only in that "corresponding to" has been replaced with "depending on" which does not add any technical limitation. The statements regarding feature (f') therefore apply *mutatis mutandis* to feature (f'').

2.1.5 The limitation added in **feature (k')** expresses that the control cycle of the control device, which is synchronous with the "forwarding cycle", is the output refresh period of the control device. Industrial controllers produce their output data for controlling a process based on input data in particular derived from the process which means that the basis for calculating the output data does only change when new input data are available. It was therefore common general knowledge at the application's priority date to align the update rate of the input data, i.e. the forwarding cycle, and the update rate of the output data of the control device, i.e. the control cycle.

2.1.6 **Feature (m)** only specifies the type of sensor the data acquisition system is used for which does not provide any synergetic or surprising effect. A "load cell" was a commonly used "force sensor" without any particular characteristics which could have deterred a skilled person from using it within the system of claim 1.

2.1.7 **Feature (n)** does not add any further limitation, since feature (k) already states that the "forwarding cycle" is synchronous with the control cycle of the master device and feature (l) states that the forwarding cycle and thus the "control cycle" is larger than the "data acquisition cycle". This holds true for each data-processing device (see the end of feature (d)).

2.2 Hence, the features added to claim 1 of first to fifth auxiliary requests do not contribute, neither alone nor in combination, to an inventive step. Consequently, the **first to fifth auxiliary requests** are not allowable under Article 56 EPC either.

3. Sixth auxiliary request - admittance (Article 13 RPBA)

3.1 This request was filed for the first time with the written response to the board's communication under Article 15(1) RPBA. Its admittance is therefore governed by Article 13 RPBA.

3.2 Claim 1 of the **sixth auxiliary request** does not contain any reference to the "frequency range" in feature (f) and introduces, in feature (o), essentially that the acquisition of sensor data from the control objects is synchronised with the generation of control data for the control objects.

3.3 The appellant argued that, in amended claim 1, now there was a connection between the "data acquisition cycle" and removing noise. The amendments were actually made to address the objections raised under Articles 84 and 123(2) EPC in the board's communication under Article 15(1) RPBA.

3.4 The board's view on the amendments is as follows:

Feature (f''') reflects the appellant's understanding of feature (f) as set out in point 1.2 above. However, to remove the noise corresponding to the "data acquisition cycle" refers only to the scheduling of the noise removal and cannot contribute to an inventive step (see point 1.9 above). **Feature (o)** is a matter of course in control systems in which sensor data are acquired and, based on these data, control data are generated. It only makes technical sense to generate new control data if new sensor data are available.

3.5 None of the two above features can thus contribute to an inventive step. Claim 1 of the sixth auxiliary

request is therefore *prima facie* not allowable under Article 56 EPC (cf. Article 13(1), fourth sentence, RPBA). The board further notes that, according to the appellant, the amendments were intended to address clarity and added subject-matter issues. No arguments supporting a contribution to an inventive step were put forward. Therefore, irrespective of the question of "exceptional circumstances" within the meaning of Article 13(2) RPBA, the amendments introduced by the sixth auxiliary request are clearly not suitable to address, let alone overcome the inventive-step objection raised against the other claim requests.

3.6 For these reasons, the board decided not to admit the sixth auxiliary request into the appeal proceedings.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

B. Brückner K. Bengi-Akyürek

Decision electronically authenticated