BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Publication in the Official Journal ~~Yes~~ / No

File Number: T 46/90 - 3.4.2

Application No.: 83 303 421.8

Publication No.: 0 097 479

Title of invention: Adjustable process variable transmitter

Classification: G01L 27/00

D E C I S I O N
of 15 May 1991

Proprietor of the patent: HONEYWELL INC.

Opponent: Rosemount Inc.

Headword:

EPC Article 56

Keyword: "Inventive step (no)"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 46/90 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 15 May 1991

Appellant : (Proprietor of the patent)
HONEYWELL INC.
Honeywell Plaza
Minneapolis
Minnesota 55608 (USA)

Representative :
Rentzsch, Heinz
Honeywell Europe S.A. Holding KG
Patent- und Lizenzabteilung
Postfach 184
W - 6050 Offenbach am Main (DE)

Respondent(s) : (Opponent)
Rosemount Inc.
12001 West 78th Street
Eden Prairie, MN55344 (USA)

(Representative)
Cross, Rupert Edward Blount
BOULT, WADE & TENNANT
27 Furnival Street
London EC4A 1PQ (GB)

Decision under appeal :
Decision of Opposition Division of the European Patent Office dated 27 October 1989 and posted on 13 November 1989 revoking European patent No. 0 097 479 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : E. Turrini
Members : W.W.G. Hofmann
M.V.E. Lewenton

Summary of Facts and Submissions

I. European patent No. 0 097 479 was granted on the basis of European patent application No. 83 303 421.8.

II. The patent was revoked by a decision of the Opposition Division on opposition by the Respondent, on the ground that its subject-matter did not involve an inventive step. In the reasons for the decision the following documents were referred to:

(D1) US-A-4 122 719 and
(D2) "Control Engineering", April 1982, pages 89 to 94.

III. The Appellant (Patentee) lodged an appeal against this decision.

IV. During the appeal procedure the following further document cited in the European search report and in the statement of grounds for opposition was considered:

(D3) "Advances in Instrumentation" vol. 36, part 2, October 1981, pages 667 to 680.

V. At the end of oral proceedings the Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the single claim handed over at the oral proceedings.

The Respondent requested that the appeal be dismissed.

VI. The single claim now under consideration reads as follows:

"A process variable transmitter including:

a) a process variable sensor (4);

b) an analog-to-digital converter (6) for the output signal of said sensor;

c) a microprocessor (8) connected with its signal input to the output of said A/D converter (6);

d) first and second memory means associated with said microprocessor (8);

e) adjusting means also associated with said microprocessor (8) for adjusting the digital output signal of said microprocessor to particular values;

f) a digital-to-analog converter (10) connected to the output of said microprocessor (8) and providing the output signal of the transmitter (2);

c h a r a c t e r i z e d i n t h a t

g) the first memory (14) has stored therein a conversion equation for the microprocessor

$$OUTPUT = DACO + \left(\frac{INPUT - LRV}{SPAN}\right) \times DACSPAN,$$

wherein INPUT is the input signal to the transmitter, LRV and URV are the lower and upper end of range values, respectively of the input signal to the transmitter,

OUTPUT is the output signal of the transmitter,

DACO is the output of the D/A converter (10) to produce a predetermined lower end of range value of the output signal of the transmitter (e.g. 4mA),

DACSPAN is the additional output signal of the D/A converter (10) such that the total output signal corresponds to a predetermined upper end of range value of the output signal of the transmitter (e.g. 20mA),

SPAN is the difference between the URV and LRV values;

h) the second memory (18) is a non-volatile read/write memory for storing the values of LRV and SPAN;

i) for adjusting the parameters LRV and SPAN of the conversion process a first manually operable control signal source (20) is provided for generating set lower limit control signals and feeding them to the microprocessor (8) when the process variable is at its LRV value;

j) a second manually operable control signal source (22) is provided for generating set upper limit control signals and feeding them to the microprocessor (8) for calculating the SPAN parameter when the process variable is at its URV value; and

k) the previous conversion parameters contained in the second memory (18 by the conversion parameters obtained by setting the first (20) and second (22) control signal sources."

VII. The arguments presented by the Appellant are in substance as follows.

The patent in suit relates to the adjustment of the operating range of a process variable transmitter ("re-ranging") in contrast to all the cited documents which only deal with calibration of such a transmitter. Calibration is however fundamentally different from re-ranging since it requires known standard values of the process variable to be applied to the system, whereas for re-ranging the new end of range values of the process variable can be chosen and applied to the system without even knowing how high these values actually are, and the transmitter must be capable of dealing with any expectable lower end and upper end values of the input signal for transforming them into the predetermined end values of the output signal range. Therefore, in particular, the documents D1 and D3 could not teach a person skilled in the art how to construct a transmitter capable of re-ranging by a single adjustment operation.

Moreover, the subject-matter of the claim differs from both the transmitters known from documents D1 and D3 by the way of introducing the conversion parameters (features i) and j) of the claim). While according to documents D1 and D3 the slope α of the curve is introduced, the transmitter according to the claim introduces the lower and upper range values LRV and URV.

According to document D1 the conversion equation is not linear as in the present case, but contains terms of higher order.

VIII. The Respondent's arguments may be summarised as follows.

There is basically no difference between calibrating and re-ranging. In both cases a pair of input variable values are made to correspond to a pair of predetermined output values. Documents D1 and D3 describe practically the same device as that claimed in the patent in suit (and the same procedure of adjustment). It is just a matter of obvious choice for a person skilled in the art whether he wants to use such a known transmitter for calibrating or re-ranging.

The equation stated in feature g) of the claim is not in substance different from that given in document D1, other than a change in nomenclature and a known simplification from the more comprehensive equation given in this document; it is moreover substantially identical with that given in document D3.

Storing the parameters LRV and SPAN in a non-volatile read/write memory (feature h)) is known from document D3; and one could also consider the DIP switches of document D1 as forming a non-volatile memory.

The way of introducing the conversion parameters into the microprocessor according to the present claim is not different from that according to document D3 since in both cases first the LRV and URV values are stored and then for applying the transformation equation the slope of the curve (in the nomenclature of the claim: "DACSPAN/SPAN") is calculated.

Reasons for the Decision

1. The appeal is admissible.

2. As compared with the granted claim (which essentially corresponds to the original claim) the present claim is further limited by features g) and h) and k) and the part of features i) and j) relating to first and second "manually operable control signal sources".

   All of these features are disclosed in the original description on page 3, line 3 to page 3, line 33. The Board is satisfied that in the original definition of DACSPAN the skilled reader would at once recognise the term "input to the converter" to be an obvious error and to mean actually "output signal of the D/A converter (10)", and that in view of, in particular, the more general disclosure of the original claim, the indicated values of 4mA and 20mA clearly stand for the more general lower and upper end of range values of the output signal of the transmitter.

   The Board therefore sees no violation of Article 123 (2) and (3) EPC.

3. Both parties agreed that the amended claim submitted at the oral proceedings was sufficiently clear, and the Board shares this view.

4. Novelty

4.1 Document D3 (cf. in particular page 667 ("abstract"), page 670 (chapter "mainframe design") and page 671 (paragraph "calibrate") discloses a process variable transmitter having a process variable sensor (pressure sensor), an A/D converter, a microprocessor, first and second memory means one of which stores a conversion equation and the other of which is a non-volatile read/write memory for storing the zero and span coefficients, and adjusting means for adjusting the digital output signal of the microprocessor to particular values.

For adjusting the lower and upper end of range values (LRV and URV) of the input signal to the transmitter, and consequently also of the span value, commands from the user act upon the microprocessor for initiating calibration (i.e. in the wording of the claim: first and second manually operable control signal sources feed set lower limit control signals and set upper limit control signals to the microprocessor) when a lower end of range value and an upper end of range value, respectively, of the pressure (LRV and URV values of the process variable) are applied to the transducer (cf. page 670, third paragraph of chapter "Mainframe design" of document D3). Thus the Board cannot agree with the argument of the Appellant that features i) and j) of the present claim specify a way of introducing the conversion parameters different from that according to document D3.

The adjusted conversion parameters replace the previous conversion parameters contained in the second memory.

The subject-matter of the present claim differs from the process variable transmitter described in document D3 in that it includes a D/A converter connected to the output of the microprocessor. Document D3 is mainly concerned with digital output, although on page 672, first and second paragraph of chapter "Instrument Interfacing", the mention of current loop interfaces might point to the existence of a D/A converter. In any case, however, such a converter is not explicitly mentioned.

Although in both the present and the known case the conversion equation is linear and manifests the same dependency of the output signal on the input signal, the representation of the constants is different insofar as according to the present claim the additive constant is split up into the two components DACO and (LRV/SPAN)xDACSPAN and the multiplying constant is expressed as DACSPAN/SPAN. This has no consequences regarding the result of the conversion calculation, although it may have consequences regarding the question which of the stored parameters are stored in the non-volatile read/write memory, that is, whereas it is LRV and SPAN in the present case (DACO and DACSPAN being apparently stored in the "first" memory), it is C_0 (corresponding, in the nomenclature of the patent in suit, to (DACO - (LRV/SPAN)xDACSPAN)) and C_1 (corresponding to (DACSPAN/SPAN)) in the case of document D3.

4.2 A similar disclosure concerning a temperature transmitter is contained in document D1 (cf. in particular column 2, lines 47 to 52; column 3, lines 24 to 27; column 4, lines 1 to 40; column 5, lines 6 to 66; and figure 1). In addition to most of the features of the subject-matter of

the present claim known from document D3, document D1 also explicitly discloses a D/A converter connected to the output of the microprocessor.

However, the constants of the conversion equation are not stored in a non-volatile read/write memory, but in sets of dip switches. Contrary to the opinion of the Respondent, the Board cannot consider the term non-volatile read/write memory to comprise sets of dip switches.

The comments made in point 4.1 regarding the constants of the conversion equation also apply to the case of document D1. Moreover, in this known case the conversion equation is not linear, but contains terms of higher order.

4.3 Document D2 is considered less relevant by the Board since it does not mention any specific means for changing parameters and storing them in the microprocessor.

4.4 Therefore, the subject-matter of the claim is novel in the sense of Article 54 EPC.

5. Inventive step

5.1 The problem underlying the patent in suit relates to providing a process variable transmitter which has a variable operating range that is set by a single adjustment operation (column 1, lines 46 to 49 of the patent specification) consisting of only two steps, one step for each of the two adjustment parameters (cf. column 3, lines 8 to 10).

The first part of this problem relates to setting a variable operating range ("re-ranging"). This means that new lower and upper end values of the range of the process variable can be selected and made to correspond to the

same predetermined end values of the transmitter output (e.g. the usual current loop values of 4mA and 20mA) as for the previously chosen pair of end values of the process variable (as it is done in the conventional range changing devices mentioned in the patent in suit (column 1, lines 7 to 46) or in the more special case of switching the range of a conventional analog ammeter). In contrast to this, according to document D3, an adjustment is made for the purpose of calibration (or rather "re-calibration"); i.e. if a new sensor having a differing sensitivity characteristic has replaced a previous one, the lower and upper end values of the process variable are made to again correspond to the same predetermined end values of the transmitter output as before.

In both cases the situation to be dealt with is identical at the point of the transmission line between the sensor and the A/D converter where in both cases new (possibly unknown) lower and upper end of range values of the signal are created by the change, which values are to be made to correspond to the predetermined range of output signals of the transmitter, the only difference lying in the fact that in the one case (re-ranging) the change is brought about at points before the sensor is reached, and in the other case (re-calibrating) within the sensor itself. Since the functioning of the microprocessor part of the transmission line is quite independent of where the changes of its input values come from, the above difference is actually irrelevant.

The Board is also convinced that a person skilled in the art is well aware of this equivalence between re-calibrating and re-ranging, and consequently of the fact that a device suitable for re-calibration by determining a new pair of conversion constants could also be expected to be suitable for re-ranging.

Therefore, the fact of using the transmitter disclosed in document D3 for solving the problem of re-ranging cannot be considered as involving an inventive step.

The second part of the problem of the patent in suit, i.e. the adjustment by a single two step adjustment operation, is already expressly solved by the transmitter disclosed in document D3 where the only two steps of adjustment are explicitly described.

All the above considerations regarding the comparison of the problems solved according to document D3 and the patent in suit apply just as well to document D1. However, as indicated in points 4.1 and 4.2 above, document D3 has some more details of the specific construction of the microprocessor in common with the present patent, and is therefore considered to be the closest to the present subject-matter.

5.2 As outlined in point 4.1 above, the transmitter specified in the present claim is distinguished from the subject-matter of document D3 by the presence of a D/A converter and by a different form in which each of the two conversion constants is allocated to the first and second memory.

Having the output of the transmitter in analog form is a self-evident alternative to the digital output described in document D3. This fact is not only illustrated by the alternative use of a D/A converter in the transmitter of document D1 (column 3, lines 24 to 27 and column 5, lines 63 to 66), but also by the mention of a current loop (i.e. analog) interface in document D3 itself (page 672, first and second paragraph of chapter "Instrument Interfacing").

The question whether the values stored in the non-volatile read/write memory are LRV and SPAN (present claim) or the conversion constants C_o and C_1 of the simplest form of the conversion equation (document D3), only amounts to the question whether the calculation of these constants Co and C1 from the measured values LRV and URV is performed before or after storing their data in the non-volatile memory. None of the parties has submitted any arguments regarding differing effects resulting from these alternatives, and the Board is of the opinion that for a transmitter intended for having a variable operating range set by a single adjustment operation, it is quite irrelevant which alternative is chosen. Such irrelevant choice can be made by any person skilled in the art without exercising inventive activity.

Neither one of the two above-mentioned distinguishing features of the present claim has any relevance with respect to the solution of the specific problem (re-ranging) underlying the patent in suit. A person skilled in the art would choose these features for a process variable transmitter irrespective of whether he had calibration in mind, or re-ranging.

5.3 The Board therefore comes to the conclusion that the subject-matter of the single claim of the patent in suit lacks an inventive step (Article 56 EPC). Thus said claim does not meet the requirements of Article 52(1) EPC.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: **The Chairman:**

P. Martorana E. Turrini