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Datasheet for the decision
of 5 February 2015

Case Number: T 1238/11 - 3.5.03

Application Number: 06839108.5

Publication Number: 1969429

IPC: G05B13/04, G05B17/02,
                                  G05B19/418, G05B23/02

Language of the proceedings: EN

Title of invention:
MULTI-OBJECTIVE PREDICTIVE PROCESS OPTIMIZATION WITH
CONCURRENT PROCESS SIMULATION

Applicant:
Fisher-Rosemount Systems, Inc.

Headword:
Process control system/FISHER-ROSEMOUNT

Relevant legal provisions:
EPC Art. 123(2)

Keyword:
Amendments - added subject-matter (yes)

Decisions cited:

Catchword:

Beschwerdekammern
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Chambres de recours

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Case Number: **T 1238/11 - 3.5.03**

D E C I S I O N
of Technical Board of Appeal 3.5.03
of 5 February 2015

Appellant: (Applicant)	Fisher-Rosemount Systems, Inc. Emerson Process Management 12301 Research Blvd. Research Park Plaza III Austin, TX 78759 (US)
Representative:	Bohnenberger, Johannes Meissner, Bolte & Partner GbR Widenmayerstrasse 47 80538 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 22 November 2010 refusing European patent application No. 06839108.5 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	F. van der Voort
Members:	K. Schenkel
	M.-B. Tardo-Dino

Summary of Facts and Submissions

I.   This appeal is against the decision of the examining
        division refusing European patent application
        No. 06839108.5 (publication number EP 1969 429), which
        was originally filed as international application
        PCT/US2006/046590 (publication number WO 2007/067645).

II.   With the statement of grounds of appeal the appellant
        filed a set of new claims and submitted arguments in
        support. Oral proceedings were conditionally requested.

III.   In a communication annexed to a summons to oral
        proceedings the board raised, without prejudice to its
        final decision, objections under Article 123(2) EPC and
        under Article 52(1) EPC in combination with Article 56
        EPC (lack of inventive step) in respect of the subject-
        matter of claims 1 and 16.

IV.   In response to the summons, the appellant filed with a
        letter dated 5 January 2015 a substantive response
        together with claims of a main request, a first
        auxiliary request and a second auxiliary request, which
        replaced the claims on file.

V.   Oral proceedings were held on 5 February 2015.

        The appellant requested that the decision under appeal
        be set aside and that a patent be granted on the basis
        of the claims of the main request or, in the
        alternative, on the basis of the claims of the first or
        the second auxiliary request, all requests as filed
        with the letter dated 5 January 2015.

        At the end of the oral proceedings, after deliberation,
        the chairman announced the board's decision.

VI.   Claim 1 of the **main request** reads as follows:

"A process control system (100) for controlling a
process (500), comprising:
a process simulator (750) adapted to simulate the
process and produce a simulated output of the process,
wherein the simulated output includes one or more
predicted future values of the process; and
a multiple-input/multiple-output controller (818)
adapted to produce, during each operational cycle of
the process control system, multiple control outputs
configured to control the process based on a set of
target values provided to the multiple-input/multiple
output controller from an optimizer (814) during each
operational cycle of the process control system,
characterised in that:
the optimizer (814) is adapted to develop the set of
target values by applying measured inputs from the
process (500) and based on the simulated output from
the process simulator."

VII.   Claim 1 of the **first auxiliary request** differs from
claim 1 of the main request in that the characterizing
portion reads as follows:

"characterised in that:
the optimizer (814) is adapted to receive process
inputs from the process (500) and develop the set of
target values based on the process inputs and the
simulated output from the process simulator."

VIII.   Claim 1 of the **second auxiliary request** differs from
claim 1 of the first auxiliary request in that the
following feature is added at the end of the claim:

",wherein the process simulator is adapted to simulate the process independent of the optimizer"

Reasons for the Decision

1.   *Main request* - Art 123(2) EPC

1.1   Claim 1 includes the following feature relating to the optimizer and the way the optimizer generates the target values (underlining added by the board):

"the optimizer (814) is adapted <u>to develop the set of target values by applying measured inputs from the process</u> (500) and based on the simulated output from the process simulator".

It has to be assessed whether this feature is directly and unambiguously derivable from the application as filed.

1.2   With respect to this feature, claim 1 as originally filed reads as follows (underlining added by the board):

"an optimizer adapted to develop a set of target values <u>based on</u> measured inputs from the process and based on the simulated output from the process simulator".

This wording specifies, in other words, that the development of the set of target values depends on the measured inputs, but gives no further information on how or at which point the measured values from the process affect the development of the set of target values. However, claim 1 of the main request specifies that the optimizer is adapted to develop the set of target values <u>by applying</u> measured inputs from the

process. Hence, claim 1 as originally filed does not provide a sufficient basis for the feature in question.

1.3   The appellant argued that a basis for the amendments in claim 1 of the main request could be found in paragraphs [0016] and [0019] of the description.

1.3.1   As concerns paragraph [0016], the relevant phrase reads "The simulated process outputs may be applied to the optimizer up to the steady state of the process, and the optimizer may also utilize real process inputs." (underlining added by the board). However, this phrase gives no further indication about the purpose or details of the utilization of the real process inputs by the optimizer. Hence, it cannot be derived from this paragraph that the optimizer is adapted to develop the set of target values by applying measured inputs from the process.

Further, the examples given in the description which could be interpreted as a utilization of real process inputs by the optimizer do not provide sufficient basis either. The term "process inputs" is used throughout the description for specifying inputs to the process (see, for example, paragraphs [0006], [0010], [0046], [0129] and, in particular, [0152]). In paragraph [0152] it is stated that the "manipulated variables are process inputs". Since the target values developed by the optimizer have, via an MPC (model predictive control) controller, an effect on the manipulated variables (Fig. 3 and paragraph [0047]), i.e. the process inputs, the term "process inputs" may be interpreted such that the optimizer utilizes real process inputs in order to achieve the desired behaviour of the process. However, this does not provide a basis for the feature according to which the

optimizer is adapted to use the process inputs in order
to develop the set of target values.

If the phrase "the optimizer may also utilize real
process inputs" were to support that the optimizer is
adapted to develop the set of target values by applying
measured inputs from the process, the term "process
inputs" would have to be interpreted as signals coming
from the process and having an effect on the optimizer.
In fact, the description of the preferred embodiment
shows one example where an effect from a value
originating from the process on the optimizer can be
seen. In paragraphs [0139] to [0142] together with
Fig. 10 one aspect of the process simulation is
described in greater detail. In particular, it is
described that measurements of actual process variables
784, 786 and 788 are fed into model regenerators 780 to
correct the process models used for simulation. Later,
the corrected models are used for optimization as
stated in paragraph [0142]: "An example of a combined
MPC and optimizer system in which these updated models
produced by the simulation system may be used for MPC
controller generation, optimizer generation ...". This
is also apparent from paragraph [0150] which states: "A
result of this arrangement is the consistency of models
used in the model predictive control, process
simulation and optimization". However, this procedure
only shows an effect of measured process variables on
the model which in turn has an effect on the optimizer.

Thus, in the only example given in the description in
which real or measured values from the process are used
by the optimizer, the purpose is to achieve a
consistency in the models used for simulation and
optimization, i.e. not to develop the set of target
values. Paragraph [0016] does not therefore provide

support for an interpretation according to which the optimizer utilizes real inputs from the process in order to develop the set of target values.

1.3.2   As concerns paragraph [0019], the relevant phrase reads "Optimization performance is improved by using real-time process simulation and by applying measured inputs from the process to the optimizer for predicted steady-state values.".

The appellant argued that the wording "applying measured inputs from the process to the optimizer <u>for</u> predicted steady-state values" (underlining added by the board) is to be interpreted in the sense that the measured inputs are applied to the optimizer <u>instead</u> of the predicted steady-state values. Taking into account the fact that the term "predicted steady-state values" is used for the predicted values for the control, auxiliary and manipulated variables CVSS, AVSS and MVSS (paragraph [0048]) and that these predicted values are in fact provided via the input processing filter to the optimizer (Fig. 3), such an interpretation is a prerequisite if paragraph [0019] were to be found a sufficient basis for the feature in question.

However, for the following reasons, the board found no basis for such an interpretation:

The application as filed does not, either in the summary or in the detailed description, give an example of an embodiment in which measured values are provided to the optimizer. Further, as stated at point 1.3.1, the only use of measured values related to the optimizer is for correcting the models used for simulation and optimization. In paragraph [0140] it is stated that, for this purpose, the model regeneration

blocks may use a measurement indicative of an actual
process variable and compare it to the output of the
simulation block corresponding to the measured process
variable. In the board's view, in order to check the
quality of the simulation of a variable, it is
mandatory to compare a simulated value for this
variable with a measured value for this variable. Since
the predicted steady-state values mentioned in the
relevant phrase of paragraph [0019] are generated by
simulation, the statement of paragraph [0140] applies
to these values as well. From these two paragraphs it
follows that, in order to improve the simulation of the
predicted values for the control, auxiliary and
manipulated variables CVSS, AVSS and MVSS, referred to
as "predicted steady-state values", measured values for
these variables would have to be used. Thus, in the
light of the examples given in the application,
paragraph [0019] is to be interpreted such that values
for the variables which are simulated, i.e. the
"predicted steady-state values", are provided to the
optimizer for the purpose of improving the models used
by the optimizer.

Further, the above-cited phrase of paragraph [0019]
states that the measured inputs are applied for
predicted steady-state values, whereas in the feature
in question of claim 1 the measured inputs are applied
without further limitation.

1.4   Hence, it is not directly and unambiguously derivable
        from the application as filed that the optimizer is
        adapted to develop the set of target values by applying
        measured inputs from the process. Consequently, claim 1
        of the main request contains subject-matter which
        extends beyond the content of the application as filed

and, hence, does not meet the requirement of Article 123(2) EPC.

1.5   The main request is therefore not allowable.

2.   *First auxiliary request* - Art 123(2) EPC

2.1   Claim 1 includes the following feature relating to the optimizer and the way the optimizer generates the target values (underlining added by the board):

         "the optimizer (814) is adapted <u>to receive process inputs from the process</u> (500) and develop the set of target values based on the process inputs and the simulated output from the process simulator".

2.2   The term "process inputs from the process" is interpreted as referring to signals coming from the process, since the optimizer, according to the above feature, is adapted to receive them.

         However, the feature that the optimizer is adapted to receive process inputs from the process is not directly and unambiguously derivable from the application as filed.

         The description discloses that measured values from the process are used to update or correct the process models used for a simulation (paragraphs [0029], [0139], [0143] and [0147]) and that the models used for optimization are based on the simulation models (paragraph [0142], claims 5 and 10), in order to provide consistency of models (paragraph [0150]). However, the application does not disclose that the measured values themselves are received by the optimizer.

2.3   Claim 1 of the first auxiliary request therefore
       contains subject-matter which extends beyond the
       content of the application as filed and, hence, does
       not meet the requirement of Article 123(2) EPC.

2.4   The first auxiliary request is therefore not allowable.

3.   *Second auxiliary request* - Art 123(2) EPC

3.1   Claim 1 of the second auxiliary request
       (see point VIII) includes the same feature of claim 1
       of the first auxiliary request as referred to above at
       point 2.1. The reasons in respect of claim 1 of the
       first auxiliary request apply *mutatis mutandis* to claim
       1 of the second auxiliary request.

3.2   Consequently, claim 1 of the second auxiliary request
       contains subject-matter which extends beyond the
       content of the application as filed and, hence, does
       not meet the requirement of Article 123(2) EPC.

3.3   The second auxiliary request is therefore not
       allowable.

4.   There being no allowable request, it follows that the
       appeal must be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Rauh   F. van der Voort

Decision electronically authenticated