TECHNICAL REPORT

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Industrial automation — Shop floor production —

Part 2:
Application of the reference model for standardization and methodology

Automation industrielle — Production en atelier —

Partie 2: Application du modèle de référence pour la normalisation et la méthodologie

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Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The main task of ISO technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art"), for example .

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 10314-2, which is a Technical Report of type 3, was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration.*

This document is being published in the form of a Technical Report because it is not possible, in view of the current state of the art of modelling for manufacturing, to draw up an International Standard which would be complete and precise, and which would not be too restrictive in this rapidly changing field. This Technical Report is intended as a guideline and will be reviewed and augmented periodically,

ISO/TR 10314 consists of the following parts under the general title *Industrial automation— Shop floor production:*

- *Part 1: Reference model for standardization and a methodology for identification of requirements*
- *Part 2: Application of the reference model for standardization and methodology*

0 INTRODUCTION

Technical Report 10314 - Reference Model for Shop Floor Production Standards has been issued as two parts. Part 1 of TR 10314 (hereinafter referred to as "Part 1") describes "A Reference Model for Standardization and a Methodology for Identification of Standards Requirements" for industrial automation. The enclosed Part 2 deals with the "Application of the Reference Model and Methodology" to the general area of industrial automation shop floor production standards. Additional parts of TR 10314 may be developed to further focus the model and methodology described in Part 1 to specific areas of technology or application. The need for additional parts to TR 10314 has yet to be determined.

The goal of Part 2 of TR 10314 is to identify potential areas for shop floor production industrial automation standards. Part 2 of TR 10314 consists of this introduction and six chapters. Chapter 1 defines the Scope of this project and it is similar to that provided in Part 1. Chapter 2 discusses in detail the matrix concept presented in Part 1, and presents the classifications and criteria used to provide the headings for the rows and columns of the matrices. The procedures used to identify the individual boxes within a matrix are also presented. A more detailed guide to using these procedures is provided in Chapter 3. Chapter 4 uses the reference model and the methodology to identify areas of standardization. Finally, Chapter 5 is a review of the recommendations that were derived during this exercise of the reference model.

It should be noted that the Reference Model defined in Part 1 of TR 10314 can be used to identify potential areas of standardization, and also as a cataloging system to compile standards that apply to a given area. This document exercises the reference model to identify and catalog industrial automation standards at the level of international standards. Via this exercise, the overlap between potential areas of standardization, and existing standards and/or standards projects could be analyzed. What the model can not provide is a mechanism to assign priorities to potential areas of standardization. Priorities, in terms of the need for international standards, are dependent upon many factors including: perceived need, resources available, and alternative solutions. A number of ranking systems exist to quantify these, and other factors, to develop a prioritisation of potential standard work. The Working Group developing the Reference Model felt that the prioritisation of projects is best left to the member bodies of ISO.

National bodies and other international organisations may wish to use this model to catalog their existing industrial automation standards and standards projects. Via this exercise, they may obtain direction with respect to areas where national standards may be used as the basis for ISO or IEC new work items. In addition, they will be able to identify areas of work that are not covered by either national or international projects. These "gaps" may be ideal areas to focus new standards projects.

As indicated, the results of this work identify potential areas of standardization, and provide a means to catalog existing standards and standards projects. The model does not provide a means to design industrial automation systems, and it does not indicate whether the standards within a given area are sufficient for all areas of application. The design of a system, and the adequacy of a standard, or a set of standards, are application specific and can not be dealt with at this time with a general modelling construct.

Industrial automation — Shop floor production —

Part 2:
Application of the reference model for standardization and methodology

1 SCOPE

This report presents and describes a means of identifying where new or revised manufacturing standards may be required. It establishes a Reference Model for Shop Floor Production, which is then used as the basis for developing a methodology for the identification and extraction of areas for standards. The assumptions used to develop the Reference Model are:

- the field of interest is the manufacture of discrete parts and in particular the production (physical realisation) of these parts,
- the Reference Model needs to be open-ended so that it can be revised to incorporate new technologies, and
- the Reference Model needs to be generic in nature so that it can be applied to a wide range of applications and is not directed to a particular organisational structure of manufacturing.

It is emphasised that the Reference Model:

- provides a conceptual framework for understanding discrete parts manufacturing and
- can be used to identify areas of standards necessary to integrate manufacturing systems.

The Reference Model does not however provide a methodology for designing, implementing, operating and maintaining any existing or future manufacturing automation system. There may be a need to develop other Reference Models which can be used for those purposes, perhaps based on the work described in this report. The development of such models is beyond the scope of this technical report.

2 METHODOLOGY FOR IDENTIFICATION OF AREAS OF STANDARDS

Procedures for using the reference model, a methodology, are needed for a guide on how to use the reference model, how to identify areas for standardization and subsequently how to derive areas of standards requirements. These procedures are described in detail in the "Reference Model for Manufacturing Standards, Part 1", and are summarised below.

2.1 AN OVERVIEW OF THE REFERENCE MODEL

Discrete Parts Manufacturing has been represented by twelve major functions. These are:

1. Corporate Management
2. Finance
3. Marketing & Sales
4. Research & Development
5. Product Design & Production Engineering
6. Production management
7. Procurement
8. Shipping
9. Waste Material Treatment
10. Resources management
11. Maintenance Management
12. Shop Floor Production

The Reference Model described here concentrates on the last of these twelve functions, Shop Floor Production, and its environment or Context Functions, which constitute the first eleven functions. Shop Floor Production is the primary function directly engaged in producing parts.

Shop Floor Production is represented in Part 1 by a four level Shop Floor Production Model or SFPM. It is quite likely that specific manufacturing implementations may require more or less than four levels, but four levels seem sufficient for the purpose of identifying areas of standards. The four levels of activity are as shown in Figure 1 (reproduced from Part 1), namely:

Level 1 Equipment.
Execute shop floor production processes.

Level 2 Station.
Command shop floor production processes.

Level 3 Cell.
Coordinate shop floor production processes.

Level 4 Section/Area.
Supervise shop floor production processes.

	Level	Sub-Activity	Responsibility
4	Section /Area	Supervise shop floor production process	Supervising and co-ordinating the production and supporting the jobs and obtaining and allocating resources to the jobs
3	Cell	Co-ordinate shop floor production process	Sequencing and supervising the jobs at the shop floor production process
2	Station	Command shop floor production process	Directing and co-ordinating the shop floor production process
1	Equipment	Execute shop floor production process	Executing the job of shop floor production according to commands

Figure 1 - Shop Floor Production Model (SFPM)

A Generic Activity Model or GAM has been developed to model the execution of the various activities at each of the four levels, as shown in Figure 2 (reproduced from Part 1). The internals of the GAM represent an interrelated set of four subjects and four actions.

The four subjects are:

a) **Control Information** which includes:

(i) command information, normally flowing from a higher level to a lower level, which initiates, alters or terminates an activity,

(ii) status information which is generated in direct response to a command and normally flows in the opposite direction to the command,

(iii) request information which corresponds to control information for control interaction within a level (peer to peer), if any, and

(iv) response information which corresponds to status information for control interaction within a level (peer to peer), if any.

b) **Data**: all information other than control information required for or resulting from the performance of an activity.

c) **Material**: Material is a production object of the manufacturing activity. Material includes all the physical matter that enters the product during manufacturing: raw materials, parts and assemblies, auxiliary materials, products and scrap material.

d) **Resources**: Resources are all the physical means required to carry out the manufacturing that are not Material. Resources include transform, transport, verify and storage equipment; tools and fixtures; data processing and communication systems; software; basic resources such as supply material, energy, space and time; and personnel.

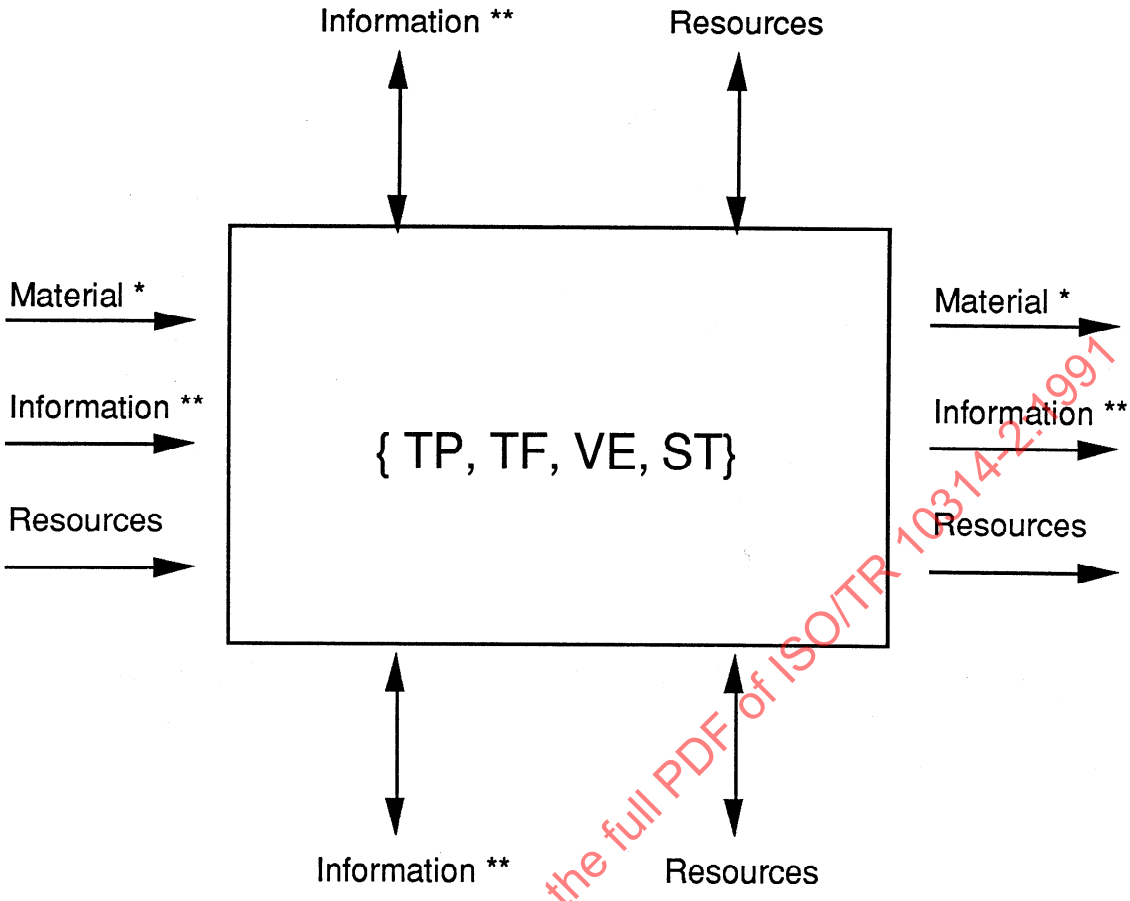
The four actions are:

a) **Transform**: The act of changing control information, data, material or resources from one form to another form, or one state to another state. Transform includes encoding or parsing information, decomposing commands, and cutting, forming, assembling, or adjusting material or resources.

b) **Transport**: The act of moving control information, data, material, or resources from one point in the enterprise to another.

c) **Verify**: The act of assessing the compliance of all transformed control information, data, material and resources to determine their conformance to a specification.

d) **Store**: The act of retaining control information, data, material or resources at a specified location within Shop Floor Production until they are required to be transported.



* Actions {TP, TF, VE, ST} on Material are defined only at Level 1

TP = Transport
TF = Transform
VE = Verify
ST = Store

** Information is defined in the text to include both control and data components. For strict hierarchies, horizontal Information flows are restricted to data components

Figure 2 - Generic Activity Model (GAM)

2.2 PROCEDURES

As described above, the environment of the Shop Floor Production Model is represented by eleven context functions. The activities on each level can be represented by specific activity models corresponding to instances of the Generic Activity Model at the four levels of the SFPM.

Two types of procedures, A and B, have been developed to be applied to the Shop Floor Production Model and the Generic Activity Model in order to identify areas of standards requirements. Procedures of type A deal with interactions of subjects and actions within one GAM on a specific level. Procedures of type B deal with interactions between the SFPM and its context functions, as well as with interactions between two GAMs located at adjacent levels of the SFPM. Note that the subject "material" is defined only at level 1 of the SFPM.

Procedures A: the "Interrelationship within a level" procedures

These procedures are used for extracting areas of standards for interrelationship between Subject and Action, Subject and Subject, and Action and Action corresponding to each level of the SFPM.

For each activity, these procedures should be applied to extract areas where standards may apply.

Procedure A1: **Subject-Action** interrelationship

For each activity in each level of the SFPM, consider any possible Subject-Action interrelationship for applicable areas of standards.

Procedure A2: **Subject** interrelationship

For each activity in each level of the SFPM, consider any possible Subject-Subject interrelationship for applicable areas of standards.

Procedure A3: **Action** interrelationship

For each activity in each level of the SFPM, consider any possible Action-Action interrelationship for applicable areas of standards.

Procedures B: the "External" procedures

These procedures are used for extracting areas of standards for interrelationship between activities of the subjects of Shop Floor Production and its manufacturing context in both a vertical (between levels) and contextual (horizontal, on the same level) structure.

For each activity these procedures should be applied to extract areas where standards may apply.

Procedure B1: **Horizontal** (Contextual) interrelationship

Consider any possible interrelationships between activities between the subjects of Shop Floor Production and its manufacturing context for applicable areas of standards.

Procedure B2: **Vertical** interrelationship

For each level of the SFPM consider any possible Subject interrelationship with the levels above and below for applicable areas of standards, and hence relevant Subject attributes. Note that there is no level to be considered below level 1, while the context functions should be considered as forming the level above level 4.

For each of these procedures matrices are developed in chapter 3 whose elements correspond to areas for standardization, and which can be populated by applying the procedures above.

2.3 CLASSIFICATION OF AREAS FOR STANDARDS

Part 1 of the Reference Model introduced an overall approach to identifying areas for standards (in Figure 5 of that document). However when extracting areas for standardization it is necessary to interpret the identified areas in terms of relevant technologies, and in terms of the qualities desired from the standards. The following Figure 3 shows how the general issues raised by the Procedures of Part 1 (A1,A2,A3,B1,B2) are made concrete by the introduction of the two concepts of Standard Viewpoints and Base Technologies.

The standard viewpoints are:

- Performance
- Safety
- Compatibility
- Operability
- Reliability
- Maintainability
- Environment
- Description
- Qualification

The Base Technologies may change over time. BTs being considered at the present are:

- Information
- Material / Products
- Product/Production
- Tool/Device
- Instrumentation/Control
- Computer and Communication
- Human Interface

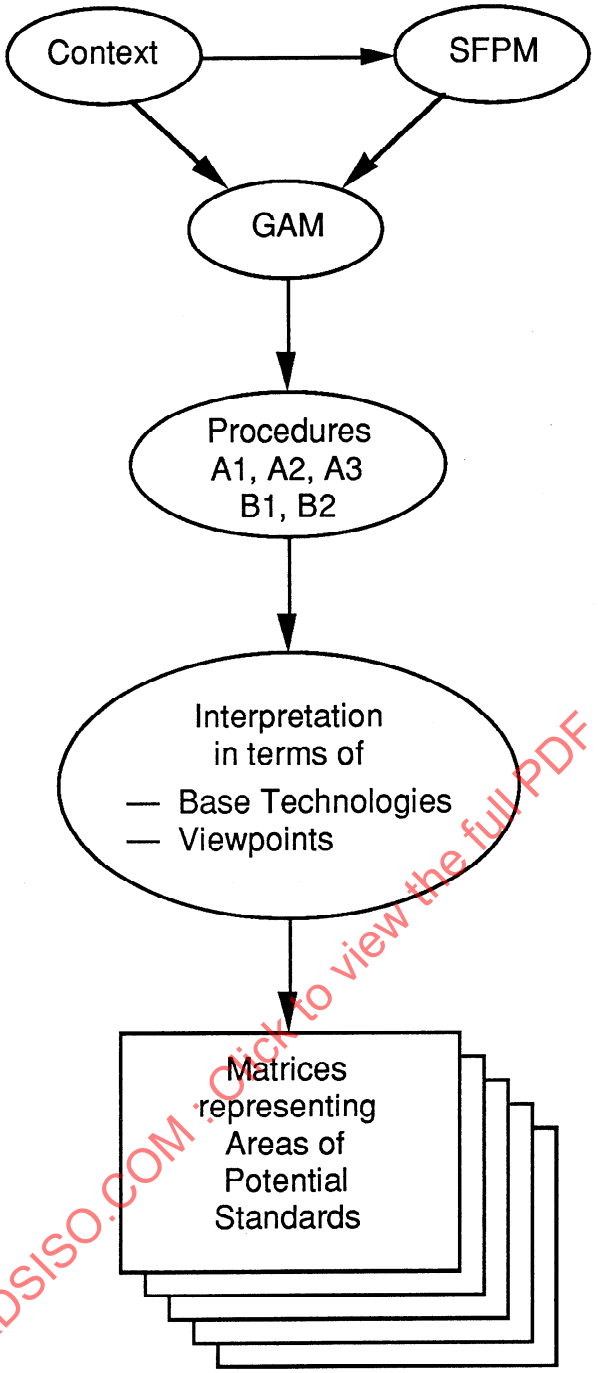


Figure 3 - Process of extracting areas for standardization

It is also necessary to have a means of representing and codifying the results of applying and interpreting the procedures. To this end, five sets of matrices are defined in sections 3.2 to 3.6, corresponding to each procedure. A unique name is also defined for each cell of each matrix to allow labelling of standards areas identified. Section 4 shows how the matrices are used to identify and label standards areas.

Annex A is a list of identified on-going standards-making activities which uses the concepts of Base Technologies, Viewpoints and the labels of the matrices. Areas identified in Section 4, but not covered in Annex A indicate potential areas for new work items.

3 GUIDE TO USING THE PROCEDURES: STRUCTURED QUESTIONS

This chapter provides a guide on how the matrices can be populated with identified areas for standardization, by means of the concept of 'structured questions' and some examples. The task of sample matrix population will be performed in chapter 4.

3.1 STRUCTURED QUESTIONS

The A and B type procedures of Chapter 2 can be recast in a generic form of structured question which uses the concepts of actions, subjects, viewpoints and BTs, and for which the process of formulation is itself a process of identification of areas of possible standards requirements. The replacement of the generic concepts shown between braces "{...}" by particular concepts leads to specific questions whose answers are specific to the area of interest.

So in the following reformulation,

{viewpoint} can be replaced by any of
Performance, Safety, Compatibility, Operability, Reliability, Maintainability, Environment, Description or **Qualification**;

{subject} can be replaced by any of
Control Information, Data, Material or **Resource**;

{action} can be replaced by any of
Transform, Transport, Verify or **Store**;

{level} can be replaced by any of
Section/Area, Cell, Station or **Equipment**;

and **{BT}** can be replaced by any of
Information, Material/ Products, Product/Production, Tool/Device, Instrumentation/Control, Computer and Communication or **Human Interface.**

The five procedures then become five structured questions, which have the general form of "Are there or should there be **{viewpoint}** standards for significant interactions between **XYZ**, realised in **{BT} technology**", where XYZ represents an "inner question" which depends on the particular procedure. So the specific forms are:

SQ-A1: Are there or should there be **{viewpoint}** standards for significant interactions between **{subject}** and **{action}** at the **{level}** level, realised in **{BT}** technology?

SQ-A2: Are there or should there be **{viewpoint}** standards for significant interactions between **{subject}** and **{subject}** at the **{level}** level, realised in **{BT}** technology?

SQ-A3: Are there or should there be **{viewpoint}** standards for significant interactions between **{action}** and **{action}** at the **{level}** level, realised in **{BT}** technology?

SQ-B1: Are there or should there be **{viewpoint}** standards for significant interactions between **{subject}** of Shop Floor Production and its manufacturing context, realised in **{BT}** technology?

SQ-B2: Are there or should there be **{viewpoint}** standards for significant interactions between **{subject}** at **{level}** and **{subject}** at the levels above or below, realised in **{BT}** technology?

As described in Part 1, the procedures can be represented in matrix form (as shown in Part 1's Figure 6). With this reformulation, the concepts **{subject}**, **{action}**, **{level}**, **{viewpoint}** and **{BT}** can be used to label each axis (dimension) as appropriate. Because the inclusion of viewpoint and BTs results in about a hundredfold increase in the size of the matrices, they will be omitted in the following general discussion on populating the matrices, although their use may well be justified and necessary in particular circumstances. In particular, they will need to be re-introduced when considering the correspondence between the identified needs for standards and areas where actual standards exist or are being developed.

It is also necessary to distinguish between the problems of identifying an area where standards may be required (the objective of the Reference Model) and that of giving a name to such an area. Such a name needs to distinguish the area from others where necessary, but also to associate it with other areas where they should sensibly be aggregated (consolidated) into a larger standards area which applies across several levels, subjects, actions or viewpoints etc. Examples might be requirements for documentation of software, or a concern for traceability. The Reference Model does not itself help with these processes of naming or aggregation (consolidation). However the use of the concepts to label dimensions allows artificial names to be constructed for individual standards areas in the form of matrix co–ordinates.

For completeness, the following section elaborates the questions for each procedure (structured question).

3.2 PROCEDURE A1: SUBJECT-ACTION INTERRELATIONSHIPS

In procedure A1 one is concerned with an individual Generic Activity Model (GAM) at a given level of the Shop Floor Production Model (SFPM), and tries to identify areas for standardization which may suggest themselves when contemplating the interrelation between subjects and actions within the GAM at the given level.

When each concept of SQ-A1 is elaborated, this becomes "should there be or are there already standards to relate:

{ Transform / Transport / Verify / Store } with { Control Information / Data / Material / Resources } at the { Section / Cell / Station / Equipment } Level?"

Clause 4.1 gives some possible interpretations for this structured question.

The corresponding matrices for levels 1 to 4 are given in Figure 4. Note that Material is considered only at Level 1.

	CONTROL INFORMATION	DATA	MATERIAL	RESOURCES
TRANSFORM	1.Tf.C	1.Tf.D	1.Tf.M	1.Tf.R
TRANSPORT	1.Tp.C	1.Tp.D	1.Tp.M	1.Tp.R
VERIFY	1.V.C	1.V.D	1.V.M	1.V.R
STORE	1.S.C	1.S.D	1.S.M	1.S.R

PROCEDURE A1 at level 1, Equipment

	CONTROL INFORMATION	DATA	RESOURCES
TRANSFORM	2.Tf.C	2.Tf.D	2.Tf.R
TRANSPORT	2.Tp.C	2.Tp.D	2.Tp.R
VERIFY	2.V.C	2.V.D	2.V.R
STORE	2.S.C	2.S.D	2.S.R

PROCEDURE A1 at level 2, Station

	CONTROL INFORMATION	DATA	RESOURCES
TRANSFORM	3.Tf.C	3.Tf.D	3.Tf.R
TRANSPORT	3.Tp.C	3.Tp.D	3.Tp.R
VERIFY	3.V.C	3.V.D	3.V.R
STORE	3.S.C	3.S.D	3.S.R

PROCEDURE A1 at level 3, Cell

	CONTROL INFORMATION	DATA	RESOURCES
TRANSFORM	4.Tf.C	4.Tf.D	4.Tf.R
TRANSPORT	4.Tp.C	4.Tp.D	4.Tp.R
VERIFY	4.V.C	4.V.D	4.V.R
STORE	4.S.C	4.S.D	4.S.R

PROCEDURE A1 at level 4, Section/Area

Figure 4 - Matrices for Procedure A1: Subject-Action Interrelationships

3.3 PROCEDURE A2: SUBJECT-SUBJECT INTERRELATIONSHIPS

For procedure A2 one again considers an individual GAM at a particular level of the SFPM, but this time considering the interrelation between the subjects of control information, material (at level 1 only), resources and data.

When each concept of SQ-A2 is elaborated, this becomes "should there be or are there already standards to relate:

{ Control Information / Data / Material / Resources } with { Control Information / Data / Material / Resources } at the { Section / Cell / Station / Equipment } Level?"

Clause 4.2 gives some possible interpretations for this structured question.

The corresponding matrices for levels 1 to 4 are given in Figure 5. (Material is to be considered only at Level 1.)

	CONTROL INFORMATION	DATA	MATERIAL	RESOURCES
CNTRL. INFO.	1.C.C	1.C.D	1.C.M	1.C.R
DATA	1.D.C	1.D.D	1.D.M	1.D.R
MATERIAL	1.M.C	1.M.D	1.M.M	1.M.R
RESOURCES	1.R.C	1.R.D	1.R.M	1.R.R

PROCEDURE A2 at level 1, Equipment

	CONTROL INFORMATION	DATA	RESOURCES
CNTRL. INFO.	2.C.C	2.C.D	2.C.R
DATA	2.D.C	2.D.D	2.D.R
RESOURCES	2.R.C	2.R.D	2.R.R

PROCEDURE A2 at level 2, Station

	CONTROL INFORMATION	DATA	RESOURCES
CNTRL. INFO.	3.C.C	3.C.D	3.C.R
DATA	3.D.C	3.D.D	3.D.R
RESOURCES	3.R.C	3.R.D	3.R.R

PROCEDURE A2 at level 3, Cell

	CONTROL INFORMATION	DATA	RESOURCES
CNTRL. INFO.	4.C.C	4.C.D	4.C.R
DATA	4.D.C	4.D.D	4.D.R
RESOURCES	4.R.C	4.R.D	4.R.R

PROCEDURE A2 at level 4, Section/Area

Figure 5 - Matrices for Procedure A2: Subject-Subject Interrelationships

3.4 PROCEDURE A3: ACTION-ACTION INTERRELATIONSHIPS

Procedure A3 examines the interrelation of actions within a GAM at a given level of the SFPM.

When each concept of SQ-A3 is elaborated,this becomes "should there be or are there already standards to relate:

{ Transform / Transport / Verify / Store } with { Transform / Transport / Verify / Store } at the { Section / Cell / Station / Equipment } Level?"

Clause 4.3 gives some possible interpretations for this structured question.

The corresponding matrices for levels 1 to 4 are given in Figure 6.

	TRANSFORM	TRANSPORT	VERIFY	STORE
TRANSFORM	1.Tf.Tf	1.Tf.Tp	1.Tf.V	1.Tf.S
TRANSPORT	1.Tp.Tf	1.Tp.Tp	1.Tp.V	1.Tp.S
VERIFY	1.V.Tf	1.V.Tp	1.V.V	1.V.S
STORE	1.S.Tf	1.S.Tp	1.S.V	1.S.S

PROCEDURE A3 at level 1, Equipment

	TRANSFORM	TRANSPORT	VERIFY	STORE
TRANSFORM	2.Tf.Tf	2.Tf.Tp	2.Tf.V	2.Tf.S
TRANSPORT	2.Tp.Tf	2.Tp.Tp	2.Tp.V	2.Tp.S
VERIFY	2.V.Tf	2.V.Tp	2.V.V	2.V.S
STORE	2.S.Tf	2.S.Tp	2.S.V	2.S.S

PROCEDURE A3 at level 2, Station

	TRANSFORM	TRANSPORT	VERIFY	STORE
TRANSFORM	3.Tf.Tf	3.Tf.Tp	3.Tf.V	3.Tf.S
TRANSPORT	3.Tp.Tf	3.Tp.Tp	3.Tp.V	3.Tp.S
VERIFY	3.V.Tf	3.V.Tp	3.V.V	3.V.S
STORE	3.S.Tf	3.S.Tp	3.S.V	3.S.S

PROCEDURE A3 at level 3, Cell

	TRANSFORM	TRANSPORT	VERIFY	STORE
TRANSFORM	4.Tf.Tf	4.Tf.Tp	4.Tf.V	4.Tf.S
TRANSPORT	4.Tp.Tf	4.Tp.Tp	4.Tp.V	4.Tp.S
VERIFY	4.V.Tf	4.V.Tp	4.V.V	4.V.S
STORE	4.S.Tf	4.S.Tp	4.S.V	4.S.S

PROCEDURE A3 at level 4, Station/Area

Figure 6 - Matrices for Procedure A3: Action-Action Interrelationships

3.5 PROCEDURE B1: HORIZONTAL (CONTEXTUAL) INTERRELATIONSHIPS

This procedure attempts to identify areas requiring standardization by considering the interface of the eleven context functions with the shop floor production in terms of subjects.

When each concept of SQ-B1 is elaborated, this becomes "should there be or are there already standards to relate:

SFP with { Corporate Management; Finance; Marketing and Sales; Research and Development; Product Des, Production Eng.; Production Management; Procurement; Shipping; Waste Material Treatment; Resources Management; Maintenance Management } in terms of { Control Information; Data; Material; Resources } ?"

Clause 4.4 gives some possible interpretations for this structured question.

The matrix of Figure 7 gives a framework to represent the activities of shop floor production. It appears from Figure 2 of Part 1 that most of corporate management's, finance's, marketing and sales', and research and development's interrelation with the shop floor production are predominantly established via product design, production engineering and production management. Remaining interrelations can at this time be governed only by guidelines, rather than standards.

	CONTROL INFORMATION	DATA	MATERIAL	RESOURCES
F1. CORPORATE MANAGEMENT	F1.C	F1.D	F1.M	F1.R
F2. FINANCE	F2.C	F2.D	F2.M	F2.R
F3. MARKETING & SALES	F3.C	F3.D	F3.M	F3.R
F4. R & D	F4.C	F4.D	F4.M	F4.R
F5. PRODUCT.DESIGN/PRODUCTION ENG.	F5.C	F5.D *	F5.M	F5.R
F6. PRODUCTION MANAGEMENT	F6.C *	F6.D	F6.M	F6.R
F7. PROCUREMENT	F7.C	F7.D	F7.M *	F7.R
F8. SHIPPING	F8.C	F8.D *	F8.M *	F8.R
F9. WASTE MATERIAL TREATMENT	F9.C	F9.D	F9.M *	F9.R
F10. RESOURCE MANAGEMENT	F10.C	F10.D	F10.M	F10.R*
F11. MAINTENANCE MANAGEMENT	F11.C *	F11.D	F11.M	F11.R

PROCEDURE B1

Figure 7 - Matrix for Procedure B1: Horizontal (Contextual) Interrelationships

(The cells marked with asterisks were identified in Figure 2 of Part 1, in 'Typical Arrangements of Manufacturing Functions'.)

3.6 PROCEDURE B2: VERTICAL INTERRELATIONSHIPS

Procedure B2 is similar to procedure A2, except that it deals with the interrelation of subjects between a GAM on one level and a GAM on levels above or below, and the interrelation is in practice limited to transport of subjects.

When each concept of SQ-B2 is elaborated, this becomes "should there be or are there already standards to relate:

{ Control Information / Data / Resources } transported across the { Section/Cell / Cell/Station / Station/Equip } Levels?"

Clause 4.5 gives some possible interpretations for this structured question.

If a transport relationship is identified between shop floor production and the eleven other major discrete part manufacturing functions in terms of subjects, then this relationship should be examined for level-specific standards requirements.

The corresponding matrix is given in Figure 8 for the typical example of interrelations between adjacent levels. Any interrelations between non-adjacent levels can be similarly represented and labelled.

	CONTROL INFORMATION	DATA	RESOURCE
SECTION / CELL	4/3	4/3.C	4/3.D	4/3.R
CELL / STATION	3/2	3/2.C	3/2.D	3/2.R
STATION / EQUIPMENT	2/1	2/1.C	2/1.D	2/1.R

PROCEDURE B2

Figure 8 - Matrix for Procedure B2: Vertical Interrelationships for adjacent levels

4 IDENTIFICATION OF AREAS FOR STANDARDIZATION

The following tables show some example areas of identified standards requirements without reference to viewpoints or base technologies. Viewpoints and base technologies relating to existing standards-making are illustrated in Annex A. Annex B gives the same information, but ordered by the Procedure, Level and Cell identifiers..

In the tables, the entry "x" means no standards area was identified, "–" means there is no logical interpretation for the cell and "<<" means the entry is the same as that on the left.

4.1 PROCEDURE A1: Subject-Action interrelationships

There are two interpretations for the subject-action interrelation, corresponding to the two possible directions of actions and subjects; that is actions on subjects, or subjects required for actions.

So one interpretation is the action operating on the subject, as in say the transform of material. A standard on the material transformation at level 1 corresponds to standard procedures for processing. Standards on the transportation of data at levels 2,3 and 4 correspond to standard protocols for data transmission, for example OSI standards.

The other interpretation is an interrelation between actions and subjects which are necessary for actions or used in actions. Standards on resources for transformation at level 1 correspond to standards for machine tools, assembling machines,etc. Standards on control information for transformation at level 2 corresponds to standards for numerical control commands, robots control commands, etc.

Both interpretations are considered below.

(i) Action on subject

A1 (action on subject): LEVEL 1

	Control Information	Data	Material	Resource
Tf	Conversion of signals	Conversion of signals	Processing	Assembly of fixture, Training of personnel Conversion of energy
Tp	Transmission of control information	Transmission of data	Handling of material	Transmission of power, Transport of fuel, Transport of tools, Transport of waste material
Vf	Verification of control information	Verification of data	Inspection of material	Inspection of machinery
St	Buffering of control information	Buffering of data	Storage of material	Storage of re-usable resource (e.g. fixtures, dies, tools)

Note that material is considered only at Level 1.

A1 (action on subject): LEVEL 2

	Control information	Data	Resource
Tf	Directing and coordinating equipment (NC data interpretation)	Processing of measured data (industrial unit conversion), Processing of resource data	Training of personnel
Tp	Transmission of control information in/between station(s)	Transmission of data in/between station(s)	Transmission of power
Vf	Verification of control information	Verification of data	Monitoring and diagnosis station controller (numerical control, robot, programmable logic controller etc)
St	Storage of control information	Storage of data	Storage of program

A1 (action on subject): LEVEL 3

	Control information	Data	Resource
Tf	Controlling jobs	Processing of operational data Processing of resource data	Training of personnel
Tp	Transmission of control information in/between cells	Transmission of data in/between cells	Transmission of power Transmission of program
Vf	Verification of control information	Verification of data	Monitoring and diagnosis of cell controller
St	Storage of control information	Storage of data	Storage of program

A1 (action on subject): LEVEL 4

	Control information	Data	Resource
Tf	Job planning (including scheduling & resource allocation)	Operational data processing, Resources data processing	Human training
Tp	Control information transmission in/between sections	Data transmission in/between sections	Power transmission, program transport
Vf	Control information verification	Data verification	Section controller monitor & diagnostics
St	Control information storage	Data storage	Program storage

(ii) Subjects necessary for actions

A1 (subject for action): LEVEL 1

	Tf	Tp	Vf	St
Control information	x	x	x	x
Data	x	x	x	x
Material	x	x	x	x
Resource	Machine tool, Tool, Fixture	Automatic guided vehicle, Conveyor, Pallet	Co-ordinate measuring machine, Measuring devices	Automatic warehouse

A1 (subject for action): LEVEL 2

	Tf	Tp	Vf	St
Control information	Commands to machine tool	Commands to Automatic guided vehicle/robot	Commands to Co-ordinate measuring machine	Commands to automatic warehouse
Data	Numerical control data	Automatic guided vehicle/robot control data	Automatic guided vehicle/robot control data	Automatic warehouse control data
Resource	Station controller	<<	<<	<<

A1 (subject for action): LEVEL 3

	Tf	Tp	Vf	St
Control information	Job controlling commands	<<	<<	<<
Data	Data for job scheduling (Standard operation procedure), Product model	<<	<<	<<
Resource	Cell controller	<<	<<	<<

A1 (subject for action): LEVEL 4

	Tf	Tp	Vf	St
Control information	Job planning commands	<<	<<	<<
Data	Data for job scheduling, Product model	<<	<<	<<
Resource	Section controller	<<	<<	<<

4.2 PROCEDURE A2: Subject-Subject interrelationships

As with Procedure A1, several interpretations are possible for the interrelationships - these are that of a subject with itself, of subjects for subjects and of interfaces between subjects and subjects. All three interpretations are considered below.

(i) A2 (subject with itself)

	Level 1	Level 2	Level 3	Level 4
Control information	Control information definition	<<	<<	<<
Data	Data definition	<<	<<	<<
Material	Material definition	x	x	x
Resource	Resource definition	<<	<<	<<

(ii) Subjects for subjects

A2 (subject (row) for subject (column)): LEVEL 1

	Control Information	Data	Material	Resource
Control Information	x	x	x	x
Data	Control information presentation & specification	Data presentation & specification Vocabulary	Material presentation & specification,	Resource presentation & specification
Material	x	x	x	x
Resource	Sign-board	Bar code label	Package	Consumable resource (lubrication oil, filter, etc

A2 (subject (row) for subject (column)): LEVEL 2,3,4

	Control information	Data	Resource
Control information	x	x	x
Data	Control information presentation & specification	Data presentation & specification, Vocabulary	Resource presentation & specification
Resource	Physical media (Tape, Flexible disk, etc.)	<<	Consumable resource

(iii) Interface between subjects and subjects

A2 (interface between subjects): LEVEL 1

	Control information	Data	Material	Resource
Control information	x	x	x	x
Data	–	x	x	x
Material	–	–	Part fastening	Part fixturing
Resource	–	–	–	Connector, Device connection, End effector chuck, Modular tool, User interface

A2 (interface between subjects): LEVEL 2,3,4

	Control information	Data	Resource
Control information	x	x	x
Data	–	x	x
Resource	–	–	Connector, User interface

4.3 PROCEDURE A3: Action-Action interrelationships

There are three interpretations for the action-action interrelation.

The first interpretation is an interrelation of an action with itself. It suggests areas for standardization of relevant action definitions.

The second interpretation is an interrelation of actions which are executed simultaneously with close interactions. Standards on interrelation between transformation and verification at level 1 correspond to standards for in-process inspection.

The third interpretation is an interrelation of actions which are always executed sequentially.

All three interpretations are considered below.

As one example, standards on the interrelation between transportation and transportation at levels 2,3 and 4 correspond to standards for gateways or bridges of communication network.

(i) Action with itself

A3 (action with itself)

	Level 1	Level 2	Level 3	Level 4
Tf	Transformation functional definition	<<	<<	<<
Tp	Transportation functional definition	<<	<<	<<
Vf	Verification functional definition	<<	<<	<<
St	Storage functional definition	<<	<<	<<

(ii) Concurrent actions

A3 (concurrent actions): LEVEL 1

	Tf	Tp	Vf	St
Tf	Concurrent processing	Processing during transportation	In process inspection	Aging
Tp	–	x	In line inspection	Live storage, Buffering
Vf	–	–	In line calibration	x
St	–	–	–	x

A3 (concurrent actions): LEVEL 2,3,4

	Tf	Tp	Vf	St
Tf	Parallel processing	x	x	x
Tp	–	Broad band communication	x	Buffering
Vf	–	–	x	x
St	–	–	–	x

(iii) Sequential actions

A3 (sequential actions (row to column)): LEVEL 1

	Tf	Tp	Vf	St
Tf	x	Positioning at change of action	x	x
Tp	Positioning at change of action	Change of Tp methods	Positioning at change of action	Positioning at change of action
Vf	x	Positioning at change of action	x	x
St	x	Positioning at change of action	x	x

A3 (sequential actions (row to column)): LEVEL 2,3,4

	Tf	Tp	Vf	St
Tf	x	Decoding	x	x
Tp	Encoding	Gateway, Bridge	Error checking	Information retrieval
Vf	x	Error checking	x	x
St	x	Logging	x	x

4.4 PROCEDURE B1: Contextual (Horizontal) interrelationships

In filling out the fields of the matrix of Figure 7 an example of a typical question to ask is: 'What areas of standardization can be identified through the interrelation between the specific context function *Product Design* and *Production Engineering* with the shop floor production *data*?'

An answer to this question is "Product description data". This example could be expanded by considering "Product description data" from the viewpoint of operability, qualification and maintainability with implementations in the Base Technologies of Product/Production, computer/communication and Human Interface.

	Control information	Data	Material	Resources
F1. Corporate management	Policy, General status	Reports (schedule, capacity, quality)	x	x
F2. Finance	x	Reports (shop floor costing, pricing information)	x	Budget
F3. Marketing & sales	Shop floor production order, Order status	Reports (schedule, capacity, quality)	Samples	Demonstration facilities
F4. R & D	x	Company standard product models	Physical models	Updates (e.g. software)
F5. Product design /production eng.	x	Engineering information, Bill of materials plus drawings, Product models, Process/Operation plans	Prototypes	Tooling, Software
F6. Production management	Production schedule, Production status	Production monitoring data, Cost data, Quality data, Schedule, Capacity	x	Software
F7. Procurement	Requests for materials	Inventory data	Raw material, Procured parts	Storage space
F8. Shipping Finished products	Product status for shipping x	Product inventory data	Product information,	
F9. Waste material Containers **treatment**		Waste releases and quantity	Waste description	Waste
F10. Resource management	Resource request, Resource status	Resource allocation data, Resource specification	x	Resources, Services, Consumable resources
F11. Maintenance management	Maintenance request, Calibration/ downtime schedule	Maintenance requirement, Calibration data, Fault reports, Machine usage data	x	Diagnostic programs, Diagnostic devices, Spare parts

4.5 PROCEDURE B2:Vertical interrelationships for adjacent levels

B2 (vertical interrelationship)

	Control information	Data	Resource
1 / 2	Command and status for Equipment	Sensor data	x
2 / 3	Process execution commands and status	Operational data	Software updates
3 / 4	Job execution command and status	Operational data, Resource allocation data	Software updates

5 RECOMMENDATIONS

Section 4 has shown how tables which identify areas of standards can be generated using the procedures described in section 3. Annexes A and B show corresponding current and illustrative standards-making activities as of late 1989. Using these annexes, standards-makers can identify potential areas for new work-items, while standards-users can identify some relevant standards for their own enterprise.

It is recommended that ISO TC184 SC5 and all of its WGs should use TR 10314 - Reference Model for Shop Floor Production Standards, Parts 1 and 2, as an aid in project planning. Other committees such as the ISO TC184 Advisory Group, other SCs of TC184, other industrial automation TCs and SCs within ISO and IEC, and the SCIA are also encouraged to use this model for planning purposes.

Given the flexibility of the model, it should be viable for some period of time, even though the specific examples of Annexes A and B will become outdated. Any gaps or shortcomings that are identified as the Reference Model is increasingly used should be referred to ISO TC184 SC5.

ANNEX A. MAPPING OF EXISTING STANDARDS ACTIVITIES ONTO THE MODEL

This Annex presents the results of reviewing various lists of standards-making activities against the Reference Model for Shop Floor Production Standards. While derived from a large list containing entries for many committees and projects related to manufacturing, information technology and communication standards, the information presented has been restricted to those industrial automation committees within the current scope of the Steering Committee on Industrial Automation (SCIA), that is to current projects within ISO TC184, IEC TC65 and IEC TC44. The information is based on data gathered in late 1989 and will become outdated as new work items and committee activities are approved. While it represents the best understanding of the Working Group as of early 1990, it is not intended to be a definitive list, nor to replace any ISO or IEC list of approved activities.

The headings for each table area as follows:

Orgn:	ISO or IEC
Ctte:	The relevant Technical Committee
SC:	.... Subcommittee (where appropriate)
WG:	.... Working Group (where appropriate)
Ctte/Doc:	Whether the work is an identified Report or Activity (Rep/Act), or simply an identified general committee scope (Ctte)
Scope of Activity or Standards document:	(self explanatory)
Example Standards Areas:	(self explanatory)
(Proc) Level Cell:	The Procedure used, at what Level, and for which matrix cell. (Where items appear at all four levels, the keyword "All" is used; an ampersand "&" shows where more than one cell is used; a multiplication symbol "*" is used for the product of two sets {so {Tp,V}*{M,R} would denote TpM, TpR, VM, VR})
Viewpoint:	As defined in section 2.3
Base Technology:	As defined in section 2.3

Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	(Proc) Level Cell	Viewpoint	Base Technology
IEC	TC 44		WG3	Rep/Act	Electrical Equipment of Industrial Machines - Part 1: General Requirements	Resource/Resource	(A2) 1 RR	Description	Device/Tool
IEC	TC 44		WG2	Rep/Act	Electrical Equipment of Industrial Machines - Part 3: Industrial Sewing Machines	Resource/Resource	(A2) 1 RR	Description	Device/Tool
IEC	TC 44		WG5	Rep/Act	IEC 550 - NC Equipment for machines	Resource/Resource	(A2) 2 RR	Description	Device/Tool
IEC	TC 44		WG5	Rep/Act	Interface between Numerical Controls and Industrial Machines	Resource/Resource	(B2) 1/2 R	Description	Computer & Communi-cations
IEC	TC 65	SC A	WG10	Rep/Act	Functional Safety of Programmable Electronic Systems - Generic Aspects	Verify Resource	(A2) 2,3,4 VR	Safety	Control
IEC	TC 65	SC A	WG6	Rep/Act	Language for programmable controller - Application Languages (inc Part 3)	Transform Control Information	(A1) 2,3,4 TfC	Compatibility	Information Control
IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 1: General Information	Resource Standard	(A2) 2,3,4 RR	Description	Control
IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 2: Equipment Characteristics	Resource Standard	(A2) 2,3,4 RR	Performance, Compatibility, Description	Control
IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 3: Programming Languages	Transform Control Information	(A1) 2,3,4 TfC	Compatibility	Information Control
IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 4: User Guidelines	Data for Resource	(A2) 2,3,4 DR	Operability, Maintainability	Control
IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part : Messaging Service Specification	Transport Control Info/Data	(A1) 2,3,4 TpC&D; (B2) 3/2,4/3 C&D	Compatibility	Communication
IEC	TC 65	SC A	WG8	Rep/Act	Definition of test methods for safe operation of digital industrial-process equipment	Verify Resource	(A1) All VR	Safety	Control
IEC	TC 65	SC A	WG8	Rep/Act	Evaluation of system properties for the purposes of system assessment (8 parts)	Resource Standard	(A2) 2,3,4 RR	Performance, Reliability	Production
IEC	TC 65	SC A	WG9	Rep/Act	Safe Software	Transform Control Info/Data	(A1) All TfC&D	Safety	Information
IEC	TC 65	SC A		Rep/Act	Analog Pneumatic Signals for Process Control Systems	Transport Control Info/Data	(A1) 1,2 TpC&D; (B2) 2/1 C&D	Compatibility	Communication
IEC	TC 65	SC A		Rep/Act	Binary Direct Voltage Signals for Process Measurement and Control Systems	Transport Control Info/Data	(A1) All TpC&D; (B2) All C&D	Compatibility	Communication
IEC	TC 65	SC B	WG5	Rep/Act	Thermocouples - Part 1(Amend) - Reference Tables	Verify Resource	(A2) 1 VR	Performance	Instrument

Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	(Proc) Level Cell	Viewpoint	Base Technology
IEC	TC 65	SC B	WG5	Rep/Act	Thermocouples - Part 2 (Amend) - Tolerances	Resource Standard	(A2) 1 RR	Compatibility	Instrument
IEC	TC 65	SC B	WG5	Rep/Act	Thermocouples - Part 3: Extension & Compensating Tables - Tolerances & Identification System	Data for Resource	(A2) 1 DR	Compatibility, Performance	Instrument
IEC	TC 65	SC B	WG9	Rep/Act	Control Valves Data Sheet; Sizing equations for low flow control valves	Data for Resource	(A2) 1 DR	Compatibility, Performance	Instrument
IEC	TC 65	SC B	WG9	Rep/Act	Noise Generated by Liquid Flow through Control Valves (Laboratory Measurement, Prediction)	Data for Resource	(A2) 1 DR	Compatibility, Performance	Instrument
IEC	TC 65	SC B		Rep/Act	Code of Practice for the Calculation of Response Times of Temperature Sensors etc.	Data for Resource	(A2) 1 DR	Compatibility, Performance	Instrument
IEC	TC 65	SC B		Rep/Act	Electrical, Pneumatic Chart Recorders for Industrial-Process Control Systems - Part 2	Verify Resource	(A2) 1 VR	Performance	Instrument
IEC	TC 65	SC B		Rep/Act	General Methods, Procs for Evaluation of Process Measurement, Control Devices	Verify Resource	(A2) All VR	Performance	Instrument
IEC	TC 65	SC B		Rep/Act	Guidance for Inspection, Testing of Transmitters in Industrial-Proc Control Sys - Part 2	Verify Resource	(A2) 1 VR	Performance	Instrument
IEC	TC 65	SC B		Rep/Act	IEC 546 Controller performance	Verify Resource	(A2) 2,3,4 VR	Performance, Reliability, Compatability	Control
IEC	TC 65	SC B		Rep/Act	Evaluating Performance of Valve Positioners for Industrial-Process Control Systems	Verify Resource	(A2) 1 VR	Performance, Compatability	Control
IEC	TC 65	SC B		Rep/Act	Methods for Evaluating Performance of Instruments with Two or Multistage Output etc.	Verify Resource	(A2) 1,2 VR	Performance,	Control
IEC	TC 65	SC B		Rep/Act	Standard for Fire Safe Control Valves	Resource Standard	(A2) 1 RR	Compatability	Production
IEC	TC 65	SC B		Rep/Act	Standard on Calibration Procedures for Industrial Temperature Sensors	Verify Resource	(A2) 1 VR	Performance,	Instrument
IEC	TC 65	SC C	WG1	Rep/Act	Development of Real-time Architecture (from ISA DS 72.03)	Transport Control Info/Data	(A1) 2,3,4 TpC&D; (B2) 2/1,3/2 C&D	Compatability	Communication
IEC	TC 65	SC C	WG1	Rep/Act	PMS - MMS Companion Standard for Process Control	Transport Control Info/Data	(A1) 2,3,4 TpC&D; (B2) 2/1,3/2,4/3 C&D	Compatibility	Communication
IEC	TC 65	SC C	WG1	Rep/Act	Preparation of Standards Profiles for Comms Needs of Process Control Industry	Transport Control Info/Data	(A1) 2,3,4 TpC&D; (B2) 3/2,4/3 C&D	Compatibility	Communication

Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	(Proc) Level Cell	Viewpoint	Base Technology
IEC	TC 65	SC C	WG3	Rep/Act	Amendments to Interface System for Programmable Measuring Instruments, 625-1 (Aligning Pts 1,2)	Resource Standard & Transport Control Info/Data	(A2) 1 RR; (A1) 1 TpC&D; (B2) 2/1 C&D	Compatibility	Control
IEC	TC 65	SC C	WG3	Rep/Act	Interface System for Programmable Measuring Instruments - Part 1	Resource Standard & Transport Control Info/Data	(A2) 1 RR; (A1) 1 TpC&D; (B2) 2/1 C&D	Compatibility	Control
IEC	TC 65	SC C	WG3	Rep/Act	Interface System for Programmable Measuring Instruments - Part 2	Resource Standard & Transport Control Info/Data	(A2)1 RR; (A1) 1 TpC&D; (B2) 2/1 C&D	Compatibility	Control
IEC	TC 65	SC C	WG3	Rep/Act	Investigation of a Common Application Interface for 625-2 using or not MMS	Transform Control Info/Data	(A1) 1 TfC&D	Compatibility	Communication
IEC	TC 65	SC C	WG3	Rep/Act	Preparation of a Modular Instrument System Standard	Resource Standard	(A2) 2,3,4 RR	Compatibility	Control
IEC	TC 65	SC C	WG6	Rep/Act	Fieldbus Standard	Transport Control Info/Data	(A1) 1,2 TpC&D; (B2) 2/1 C&D	Compatibility	Communication
IEC	TC 65	SC C	WG6	Rep/Act	PROWAY A/B	Transport Control Info/Data	(A1) 1,2 TpC&D; (B2) 2/1 C&D	Compatibility	Communication
IEC	TC 65	SC C	WG6	Rep/Act	PROWAY C	Transport Control Info/Data	(A1) 1,2 TpC&D; (B2) 2/1 C&D	Compatibility	Communication
IEC	TC 65	SC C	WG6	Rep/Act	PROWAY C (Addendum 5MB/s and 10MB/s)	Transport Control Info/Data	(A1) 1,2 TpC&D; (B2) 2/1 C&D	Compatibility	Communication
IEC	TC 65		SWG	Rep/Act	Protection Against an Explosion Hazard when Flammable Gas is Used etc.	Resource Standard	(A2) 1,2 RR; (B2) 2/1 R	Safety	Production
IEC	TC 65		WG1	Rep/Act	IEV: Chapter 351 - Automatic Control	Vocabulary	(A2) All DD	Description	Human Interface
IEC	TC 65		WG2	Rep/Act	Environmental Conditions - Operating Conditions for Industrial-Process Measurement - Part 1	Resource Standard	(A2) All RR	Environment	Production
IEC	TC 65		WG2	Rep/Act	Environmental Conditions - Operating Conditions for Industrial-Process Measurement - Part 2	Resource Standard	(A2) All RR	Environment	Production
IEC	TC 65		WG4	Rep/Act	Environmental Conditions - Continuous Wave Conducted Immunity Requirements	Resource Standard	(A2) All RR	Environment	Production
IEC	TC 65		WG4	Rep/Act	Environmental Condn - Electromagnetic Compatibility for Industrial-Process Measurement - Part 2	Resource Standard	(A2) All RR	Environment	Production

Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	(Proc) Level Cell	Viewpoint	Base Technology
IEC	TC 65		WG4	Rep/Act	Environmental Condn - Electromagnetic Compatibility for Industrial-Process Measurement - Part 3	Resource Standard	(A2) All RR	Environment	Production
IEC	TC 65		WG4	Rep/Act	Environmental Condn - Electromagnetic Compatibility for Industrial-Process Measurement - Part 5	Resource Standard	(A2) All RR	Environment	Production
IEC	TC 65			Rep/Act	Environmental Conditions - IEC 654, Operating Conditions for measuring and control equipment	Resource Standard	(A2) All RR	Environment	Production
IEC	TC 65			Rep/Act	Environmental Conditions - IEC 654, Surge Voltage (Operating Environment)	Resource Standard	(A2) All RR	Environment	Production
IEC	TC 65			Rep/Act	Environmental Conditions - IEC 801, Electromagnetic compatability - (Operating Environment)	Resource Standard	(A2) All RR	Environment	Production
ISO	TC 184	SC 1	WG 1	Ctte	Extended Formats and Data Structure	Transform Control Information	(A1) 2 TfC	Compatability	Information
ISO	TC 184	SC 1	WG 2	Ctte	Vocabulary	WG2, Title only	(A2) All DD	Description	Human Interface
ISO	TC 184	SC 1	WG 3	Ctte	Companion Standard to MMS (ISO 9506)	Transport Control Information	(B2) 2/3; 3/4 C	Compatability	Information
ISO	TC 184	SC 1		Ctte	Numerical Control of Machines	SC1 Title only			
ISO	TC 184	SC 2	WG 1	Ctte	Terminology and Graphical Representation	Data to Data	(A2) All DD	Description	Human Interface
ISO	TC 184	SC 2	WG 2	Ctte	Performance and Test Methods	Resource Verification	(A1) 1,2 VR	Performance	Production
ISO	TC 184	SC 2	WG 3	Ctte	Safety	Transport, Transform, Verify & Store Material & Resource	(A1) 1 {Tp,Tf,V,S} * {M,R}	Safety	Production
ISO	TC 184	SC 2	WG 4	Ctte	Robot Programing Languages - Application Languages	Transform Control Information	(A1) 1,2 TfC	Compatability	Information
ISO	TC 184	SC 2	WG 5	Ctte	Mechanical Interfaces	Transport Resources	(A1) 1 TpR	Compatability	Production
ISO	TC 184	SC 2	WG 6	Ctte	Robot Companion Standard to MMS (ISO 9506)	Transport Control Information & Data	(B2) 2/3,3/4 C&D	Compatability	Communication
ISO	TC 184	SC 2		Ctte	Performance Testing of Robots	Resource Verification	(A1) 1,2 VR	Performance	Production
ISO	TC 184	SC 2		Ctte	Robots for Manufacturing Environment	Transport, Transform, Verify & Store Material & Resource	(A1) 1 {Tp,Tf,V,S} * {M,R}	Safety	Production
ISO	TC 184	SC 2		Ctte	Standardised Data Sheets for robots	SC2 Title only			
ISO	TC 184	SC 3	WG 1	Ctte	Programming Languages for Automatically Controlled Equipment	Transform Control Information & Data	(A1) 1,2 TfC	Compatability	Information

Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	(Proc) Level Cell	Viewpoint	Base Technology
ISO	TC 184	SC 3	WG 1	Rep/Act	Revision of ISO 4342 CLDATA, 4343 APT - Application Languages	Transform Control Information & Data	(A1) 2,3 TfC	Compatability	Production
ISO	TC 184	SC 3	WG 2	Ctte	Requirements for a Global Programming Language Environment	Beyond SFRM			
ISO	TC 184	SC 3		Ctte	Manufacturing Application Languages	SC3 Title only			
ISO	TC 184	SC 4	WG 1	Rep/Act	Development of STEP	Data with Product Design	(B1) 3,4 F04D	Compatability	Information
ISO	TC 184	SC 4	WG 1	Ctte	Technical Coordination and Support	No match			
ISO	TC 184	SC 4		Ctte	External Representation of Product Definition Data	SC4 Title only			
ISO	TC 184	SC 5	WG 1	Ctte	Reference Models	Beyond SFRM			
ISO	TC 184	SC 5	WG 2	Ctte	Communications and Interconnections	Transform Control Information & Data	(B2) 2/3,3/4 C&D	Compatability	Communication
ISO	TC 184	SC 5	WG 3	Ctte	Industrial Automation Vocabulary	WG3, Title only	(A2) All DD	Description	Human Interface
ISO	TC 184	SC 5		Ctte	System Integration and Communication	SC5 Title only			
ISO	TC 184	SC1	WG1	Rep/Act	Extended Format and Data Structure (Rev: TR 6132 - 1981)	Transform Control Information	(A1) 2 TfC	Compatability	Information
ISO	TC 184	SC1	WG1?	Rep/Act	Axis and Motion Nomenclature	Resource to Resource	(A2) 1 RR	Description	Human Interface
ISO	TC 184	SC1	WG2	Rep/Act	NC Vocabulary		(A2) All DD	Description	Human Interface
ISO	TC 184	SC1	WG3	Rep/Act	NC Companion Standard to MMS (9506/4)	Transport Control Information	(B2) 2/3,3/4 C	Compatability	Information
ISO	TC 184	SC1		Rep/Act	Numerical Control of Machines - Symbols	Resource to Resource	(A2) 1 RR	Description	Human Interface
ISO	TC 184	SC1		Rep/Act	Part 2: Coding and Maintenance of Preparatory Functions G and Misc Functions M	Transform Control Information	(A1) 1,2 TfC	Compatability	Production
ISO	TC 184	SC1		Rep/Act	Part 3: Programming of Miscellaneous Functions M (Classes 1 to 9)	Transform Control Information	(A1) 1,2 TfC	Compatability	Production
ISO	TC 184	SC1		Rep/Act	Specn. of Interface Signals betw. Numerical Control Unit/Electrical Equipt. of NC m/c	Transform Control Information	(A1) 1 TfC	Compatability	Production
ISO	TC 184	SC2	WG1	Rep/Act	Robot Characteristics	No match			
ISO	TC 184	SC2	WG1	Rep/Act	Robot Vocabulary		(A2) All DD	Description	Human Interface
ISO	TC 184	SC2	WG1?	Rep/Act	Coordinate Systems and Motions	Transform Control	(A1) 1 TfC	Compatability	Production

Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	(Proc) Level Cell	Viewpoint	Base Technology
ISO	TC 184	SC2	WG2	Rep/Act	Performance Criteria and Related Testing Methods	Resource Verification	(A1) 1,2 RV	Performance	Production
ISO	TC 184	SC2	WG3	Rep/Act	Robot Safety	Transport, Transform, Verify & Store Material & Resource	(A1) 1 {Tp,Tf,V,S} * {M,R}	Safety	Production
ISO	TC 184	SC2	WG4	Rep/Act	Robot Programming Languages	Transform Control Information	(A1) 1 TfC	Compatability	Production
ISO	TC 184	SC2	WG5	Rep/Act	Mechanical Interfaces - Part 1: Circular (Form A)	Transport Resource	(A1) 1 TpR	Compatability	Production
ISO	TC 184	SC2	WG6	Rep/Act	Robot Companion Standard to MMS (9506/3)	Transport Control Information & Data	(B2) 2/3&3/4 C&D	Compatability	Communication
ISO	TC 184	SC3	WG1	Rep/Act	Extension of Basic Part Programming Reference Language	Transform Control	(A1) 1 TfC	Compatability	Production
ISO	TC 184	SC3	WG1	Rep/Act	Extension of Post Processing Commands	Transform Control Information	(A1) 1,2 TfC	Compatability	Production
ISO	TC 184	SC3	WG1	Rep/Act	NC Processor Output - Logical Structure	Transform Control Information	(A1) 2,3 TfC	Compatability	Production
ISO	TC 184	SC3	WG2	Rep/Act	Requirements for Global Programming Language Environment	Beyond SFRM			
ISO	TC 184	SC4	WG1	Rep/Act	Data Exchange and Transfer Standard Specification (STEP)	Data with Product Design	(B1) 3,4 F04D	Compatability	Information
ISO	TC 184	SC5	WG1	Rep/Act	Basic Reference Model for Automated and CAD Systems	Beyond SFRM			
ISO	TC 184	SC5	WG2	Rep/Act	Control Systems Employing Half-Duplex Transmission etc.	Transport Control Information & Data	(B2) 1/2,2/3,3/4 C&D	Compatability	Communication
ISO	TC 184	SC5	WG2	Rep/Act	Electrical and Mechanical Interface and Line Control Characteristics for Serial Data Link etc.	Transport Control Information & Data	(B2) 1/2,2/3,3/4 C&D	Compatability	Communication
ISO	TC 184	SC5	WG2	Rep/Act	Functional Standards on I-LANs	Transport Control Information & Data	(B2) 1/2,2/3,3/4 C&D	Compatability	Communication
ISO	TC 184	SC5	WG2	Rep/Act	Manufacturing Message Service - Protocol Spec.	Transport Control Information & Data	(B2) 1/2,2/3,3/4 C&D	Compatability	Communication
ISO	TC 184	SC5	WG2	Rep/Act	Manufacturing Message Service - Service Def.	Transport Control Information & Data	(B2) 1/2,2/3,3/4 C&D	Compatability	Communication
ISO	TC 184	SC5	WG3	Rep/Act	Industrial Automation Systems - Vocabulary		(A2) All DD	Description	Human Interface
ISO	TC 184		WG2	Rep/Act	Revision of ISO/TC 184 Structure	Beyond SFRM			

Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	(Proc) Level Cell	Viewpoint	Base Technology
ISO	TC 184		WG3	Rep/Act	Environmental Conditions for Discrete Parts Manufacturing - Automation Sys and Equip.	Resource to Resource	(A2) All RR	Environment	Production
ISO	TC 184			Rep/Act	Functional Standards for Real-time LANs	Transport Control Information & Data	(B2) 1/2,2/3,3/4 C&D	Compatability	Communication
ISO	TC 184			Rep/Act	Production management standard for ISO 9506	Data & Control Info with Production Management	(B1) All F06 C&D	Compatability	Communication
ISO	TC 184			Rep/Act	Real-time LANs (proposed new work item)	Transport Control Information & Data	(B2) 1/2,2/3,3/4 C&D	Compatability	Communication

ANNEX B. ILLUSTRATIVE AREAS OF STANDARDS FOR CELLS OF THE MATRICES

This Annex re-orders the material in Annex A to show illustrative examples of standard areas for each procedure, each level and each label for the cells of the corresponding matrices.

The headings for each table area as follows:

(Proc) Level Cell:	The Procedure used, at what Level, and for which matrix cell.
Orgn:	ISO or IEC
Ctte:	The relevant Technical Committee
SC:	.... Subcommittee (where appropriate)
WG:	.... Working Group (where appropriate)
Ctte/Doc:	Whether the work is an identified Report or Activity (Rep/Act), or simply an identified general committee scope (Ctte)

Scope of Activity or Standards document (self explanatory)

Example Standards Areas (self explanatory)

Viewpoint:	As defined in section 2.3
Base Technology:	As defined in section 2.3

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A1) 1 SM	ISO	TC 184	SC2	WG3	Rep/Act	Robot Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 SM	ISO	TC 184	SC 2		Ctte	Robots for Manufacturing Environment	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 SM	ISO	TC 184	SC 2	WG 3	Ctte	Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 SR	ISO	TC 184	SC2	WG3	Rep/Act	Robot Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 SR	ISO	TC 184	SC 2		Ctte	Robots for Manufacturing Environment	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 SR	ISO	TC 184	SC 2	WG 3	Ctte	Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 TfC	ISO	TC 184	SC2	WG1?	Rep/Act	Coordinate Systems and Motions	Transform Control	Compatability	Production
(A1) 1 TfC	ISO	TC 184	SC3	WG1	Rep/Act	Extension of Basic Part Programming Reference Language	Transform Control	Compatability	Production
(A1) 1 TfC	ISO	TC 184	SC3	WG1	Rep/Act	Extension of Post Processing Commands	Transform Control Information	Compatability	Production
(A1) 1 TfC	ISO	TC 184	SC1		Rep/Act	Part 2: Coding and Maintenance of Preparatory Functions G and Misc Functions M	Transform Control Information	Compatability	Production
(A1) 1 TfC	ISO	TC 184	SC1		Rep/Act	Part 3: Programming of Miscellaneous Functions M (Classes 1 to 9)	Transform Control Information	Compatability	Production
(A1) 1 TfC	ISO	TC 184	SC 3	WG 1	Ctte	Programming Languages for Automatically Controlled Equipment	Transform Control Information & Data	Compatability	Information
(A1) 1 TfC	ISO	TC 184	SC 2	WG 4	Ctte	Robot Programing Languages - Application Languages	Transform Control Information	Compatability	Information
(A1) 1 TfC	ISO	TC 184	SC2	WG4	Rep/Act	Robot Programming Languages	Transform Control Information	Compatability	Production

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A1) 1 TfC	ISO	TC 184	SC1		Rep/Act	Specn. of Interface Signals betw. Numerical Control Unit/Electrical Equipt. of NC m/c	Transform Control Information	Compatability	Production
(A1) 1 TfC&D	IEC	TC 65	SC C	WG3	Rep/Act	Investigation of a Common Application Interface for 625-2 using or not MMS	Transform Control Info/Data	Compatibility	Communication
(A1) 1 TfC&D	IEC	TC 65	SC A	WG9	Rep/Act	Safe Software	Transform Control Info/Data	Safety	Information
(A1) 1 TfM&R	ISO	TC 184	SC2	WG3	Rep/Act	Robot Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 TfM&R	ISO	TC 184	SC 2		Ctte	Robots for Manufacturing Environment	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 TfM&R	ISO	TC 184	SC 2	WG 3	Ctte	Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 TpC&D	IEC	TC 65	SC C	WG3	Rep/Act	Amendments to Interface System for Programmable Measuring Instruments, 625-1 (Aligning Pts 1,2)	Resource Standard & Transport Control Info/Data	Compatibility	Control
(A1) 1 TpC&D	IEC	TC 65	SC A		Rep/Act	Analog Pneumatic Signals for Process Control Systems	Transport Control Info/Data	Compatibility	Communication
(A1) 1 TpC&D	IEC	TC 65	SC A		Rep/Act	Binary Direct Voltage Signals for Process Measurement and Control Systems	Transport Control Info/Data	Compatibility	Communication
(A1) 1 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	Fieldbus Standard	Transport Control Info/Data	Compatibility	Communication
(A1) 1 TpC&D	IEC	TC 65	SC C	WG3	Rep/Act	Interface System for Programmable Measuring Instruments - Parts 1 & 2	Resource Standard & Transport Control Info/Data	Compatibility	Control
(A1) 1 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	PROWAY A/B	Transport Control Info/Data	Compatibility	Communication
(A1) 1 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	PROWAY C	Transport Control Info/Data	Compatibility	Communication
(A1) 1 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	PROWAY C (Addendum 5MB/s and 10MB/s)	Transport Control Info/Data	Compatibility	Communication

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A1) 1 TpM&R	ISO	TC 184	SC2	WG3	Rep/Act	Robot Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 TpM&R	ISO	TC 184	SC 2		Ctte	Robots for Manufacturing Environment	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 TpM&R	ISO	TC 184	SC 2	WG 3	Ctte	Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 TpR	ISO	TC 184	SC 2	WG 5	Ctte	Mechanical Interfaces	Transport Resources	Compatability	Production
(A1) 1 TpR	ISO	TC 184	SC2	WG5	Rep/Act	Mechanical Interfaces - Part 1: Circular (Form A)	Transport Resource	Compatability	Production
(A1) 1 VM	ISO	TC 184	SC2	WG3	Rep/Act	Robot Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 VM	ISO	TC 184	SC 2		Ctte	Robots for Manufacturing Environment	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 VM	ISO	TC 184	SC 2	WG 3	Ctte	Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 VR	IEC	TC 65	SC A	WG8	Rep/Act	Definition of test methods for safe operation of digital industrial-process equipment	Verify Resource	Safety	Control
(A1) 1 VR	ISO	TC 184	SC 2	WG 2	Ctte	Performance and Test Methods	Resource Verification	Performance	Production
(A1) 1 VR	ISO	TC 184	SC2	WG2	Rep/Act	Performance Criteria and Related Testing Methods	Resource Verification	Performance	Production
(A1) 1 VR	ISO	TC 184	SC 2		Ctte	Performance Testing of Robots	Resource Verification	Performance	Production
(A1) 1 VR	ISO	TC 184	SC2	WG3	Rep/Act	Robot Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 1 VR	ISO	TC 184	SC 2		Ctte	Robots for Manufacturing Environment	Transport, Transform, Verify & Store Material & Resource	Safety	Production

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A1) 1 VR	ISO	TC 184	SC 2	WG 3	Ctte	Safety	Transport, Transform, Verify & Store Material & Resource	Safety	Production
(A1) 2 TfC	IEC	TC 65	SC A	WG6	Rep/Act	Language for programmable controller - Application Languages (inc Part 3)	Transform Control Information	Compatibility	Information, Control
(A1) 2 TfC	IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 3: Programming Languages	Transform Control Information	Compatibility	Information, Control
(A1) 2 TfC	ISO	TC 184	SC1	WG1	Rep/Act	Extended Format and Data Structure (Rev: TR 6132 - 1981)	Transform Control Information	Compatability	Information
(A1) 2 TfC	ISO	TC 184	SC 1	WG 1	Ctte	Extended Formats and Data Structure	Transform Control Information	Compatability	Information
(A1) 2 TfC	ISO	TC 184	SC3	WG1	Rep/Act	Extension of Post Processing Commands	Transform Control Information	Compatability	Production
(A1) 2 TfC	ISO	TC 184	SC3	WG1	Rep/Act	NC Processor Output - Logical Structure	Transform Control Information	Compatability	Production
(A1) 2 TfC	ISO	TC 184	SC1		Rep/Act	Part 2: Coding and Maintenance of Preparatory Functions G and Misc Functions M	Transform Control Information	Compatability	Production
(A1) 2 TfC	ISO	TC 184	SC1		Rep/Act	Part 3: Programming of Miscellaneous Functions M (Classes 1 to 9)	Transform Control Information	Compatability	Production
(A1) 2 TfC	ISO	TC 184	SC 3	WG 1	Ctte	Programming Languages for Automatically Controlled Equipment	Transform Control Information & Data	Compatability	Information
(A1) 2 TfC	ISO	TC 184	SC 3	WG 1	Rep/Act	Revision of ISO 4342 CLDATA, 4343 APT - Application Languages	Transform Control Information & Data	Compatability	Production
(A1) 2 TfC	ISO	TC 184	SC 2	WG 4	Ctte	Robot Programing Languages - Application Languages	Transform Control Information	Compatability	Information
(A1) 2 TpC&D	IEC	TC 65	SC A		Rep/Act	Analog Pneumatic Signals for Process Control Systems	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TpC&D	IEC	TC 65	SC A		Rep/Act	Binary Direct Voltage Signals for Process Measurement and Control Systems	Transport Control Info/Data	Compatibility	Communication

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A1) 2 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	Development of Real-time Architecture (from ISA DS 72.03)	Transport Control Info/Data	Compatability	Communication
(A1) 2 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	Fieldbus Standard	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TpC&D	IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part : Messaging Service Specification	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	PMS - MMS Companion Standard for Process Control	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	Preparation of Standards Profiles for Comms Needs of Process Control Industry	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	PROWAY A/B	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	PROWAY C	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TpC&D	IEC	TC 65	SC C	WG6	Rep/Act	PROWAY C (Addendum 5MB/s and 10MB/s)	Transport Control Info/Data	Compatibility	Communication
(A1) 2 TfC&D	IEC	TC 65	SC A	WG9	Rep/Act	Safe Software	Transform Control Info/Data	Safety	Information
(A1) 2 VR	IEC	TC 65	SC A	WG8	Rep/Act	Definition of test methods for safe operation of digital industrial-process equiment	Verify Resource	Safety	Control
(A1) 2 VR	ISO	TC 184	SC 2	WG 2	Ctte	Performance and Test Methods	Resource Verification	Performance	Production
(A1) 2 VR	ISO	TC 184	SC2	WG2	Rep/Act	Performance Criteria and Related Testing Methods	Resource Verification	Performance	Production
(A1) 2 VR	ISO	TC 184	SC 2		Ctte	Performance Testing of Robots	Resource Verification	Performance	Production
(A1) 3 TfC	IEC	TC 65	SC A	WG6	Rep/Act	Language for programmable controller - Application Languages (inc Part 3)	Transform Control Information	Compatibility	Information, Control
(A1) 3 TfC	IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 3: Programming Languages	Transform Control Information	Compatibility	Information, Control
(A1) 3 TfC	ISO	TC 184	SC3	WG1	Rep/Act	NC Processor Output - Logical Structure	Transform Control Information	Compatability	Production

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A1) 3 TfC	ISO	TC 184	SC 3	WG 1	Rep/Act	Revision of ISO 4342 CLDATA, 4343 APT - Application Languages	Transform Control Information & Data	Compatability	Production
(A1) 3 TfC&D	IEC	TC 65	SC A	WG9	Rep/Act	Safe Software	Transform Control Info/Data	Safety	Information
(A1) 3 TpC&D	IEC	TC 65	SC A		Rep/Act	Binary Direct Voltage Signals for Process Measurement and Control Systems	Transport Control Info/Data	Compatibility	Communication
(A1) 3 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	Development of Real-time Architecture (from ISA DS 72.03)	Transport Control Info/Data	Compatability	Communication
(A1) 3 TpC&D	IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part : Messaging Service Specification	Transport Control Info/Data	Compatibility	Communication
(A1) 3 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	PMS - MMS Companion Standard for Process Control	Transport Control Info/Data	Compatibility	Communication
(A1) 3 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	Preparation of Standards Profiles for Comms Needs of Process Control Industry	Transport Control Info/Data	Compatibility	Communication
(A1) 3 VR	IEC	TC 65	SC A	WG8	Rep/Act	Definition of test methods for safe operation of digital industrial-process equiment	Verify Resource	Safety	Control
(A1) 4 TfC	IEC	TC 65	SC A	WG6	Rep/Act	Language for programmable controller - Application Languages (inc Part 3)	Transform Control Information	Compatibility	Information, Control
(A1) 4 TfC	IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 3: Programming Languages	Transform Control Information	Compatibility	Information, Control
(A1) 4 TfC&D	IEC	TC 65	SC A	WG9	Rep/Act	Safe Software	Transform Control Info/Data	Safety	Information
(A1) 4 TpC&D	IEC	TC 65	SC A		Rep/Act	Binary Direct Voltage Signals for Process Measurement and Control Systems	Transport Control Info/Data	Compatibility	Communication
(A1) 4 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	Development of Real-time Architecture (from ISA DS 72.03)	Transport Control Info/Data	Compatability	Communication
(A1) 4 TpC&D	IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part : Messaging Service Specification	Transport Control Info/Data	Compatibility	Communication

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A1) 4 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	PMS - MMS Companion Standard for Process Control	Transport Control Info/Data	Compatibility	Communication
(A1) 4 TpC&D	IEC	TC 65	SC C	WG1	Rep/Act	Preparation of Standards Profiles for Comms Needs of Process Control Industry	Transport Control Info/Data	Compatibility	Communication
(A1) 4 VR	IEC	TC 65	SC A	WG8	Rep/Act	Definition of test methods for safe operation of digital industrial-process equiment	Verify Resource	Safety	Control
(A2) 1 DD	IEC	TC 65		WG1	Rep/Act	IEV: Chapter 351 - Automatic Control	Vocabulary	Description	Human Interface
(A2) 1 DD	ISO	TC 184	SC5	WG3	Rep/Act	Industrial Automation Systems - Vocabulary		Description	Human Interface
(A2) 1 DD	ISO	TC 184	SC 5	WG 3	Ctte	Industrial Automation Vocabulary	WG3, Title only	Description	Human Interface
(A2) 1 DD	ISO	TC 184	SC1	WG2	Rep/Act	NC Vocabulary		Description	Human Interface
(A2) 1 DD	ISO	TC 184	SC2	WG1	Rep/Act	Robot Vocabulary		Description	Human Interface
(A2) 1 DD	ISO	TC 184	SC 2	WG 1	Ctte	Terminology and Graphical Representation	Data to Data	Description	Human Interface
(A2) 1 DD	ISO	TC 184	SC 1	WG 2	Ctte	Vocabulary	WG2, Title only	Description	Human Interface
(A2) 1 DR	IEC	TC 65	SC B		Rep/Act	Code of Practice for the Calculation of Response Times of Temperature Sensors	Data for Resource	Compatibility, Performance	Instrument
(A2) 1 DR	IEC	TC 65	SC B	WG9	Rep/Act	Control Valves Data Sheet; Sizing equations for low flow control valves	Data for Resource	Compatibility, Performance	Instrument
(A2) 1 DR	IEC	TC 65	SC B	WG9	Rep/Act	Noise Generated by Liquid Flow through Control Valves (Laboratory Measurement, Prediction)	Data for Resource	Compatibility, Performance	Instrument
(A2) 1 DR	IEC	TC 65	SC B	WG5	Rep/Act	Thermocouples - Part 3: Extension & Compensating Tables - Tolerances & Identification System	Data for Resource	Compatibility, Performance	Instrument

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A2) 1 RR	IEC	TC 65	SC C	WG3	Rep/Act	Amendments to Interface System for Programmable Measuring Instruments, 625-1 (Aligning Pts 1,2)	Resource Standard & Transport Control Info/Data	Compatibility	Control
(A2) 1 RR	IEC	TC 44		WG3	Rep/Act	Electrical Equipment of Industrial Machines - Part 1: General Requirements	Resource/Resource	Description	Device/Tool
(A2) 1 RR	IEC	TC 44		WG2	Rep/Act	Electrical Equipment of Industrial Machines - Part 3: Industrial Sewing Machines	Resource/Resource	Description	Device/Tool
(A2) 1 RR	IEC	TC 65		WG4	Rep/Act	Environmental Conditions - Continuous Wave Conducted Immunity Requirements	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65			Rep/Act	Environmental Conditions - IEC 654, Operating Conditions for measuring and control equipment	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65			Rep/Act	Environmental Conditions - IEC 654, Surge Voltage (Operating Environment)	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65			Rep/Act	Environmental Conditions - IEC 801, Electromagnetic compatability - (Operating Environment)	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65		WG2	Rep/Act	Environmental Conditions - Operating Conditions for Industrial-Process Measurement - Part 1	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65		WG2	Rep/Act	Environmental Conditions - Operating Conditions for Industrial-Process Measurement - Part 2	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65		WG4	Rep/Act	Environmental Condn - Electromagnetic Compatibility for Industrial-Process Measurement - Part 2	Resource Standard	Environment	Production

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A2) 1 RR	IEC	TC 65		WG4	Rep/Act	Environmental Condn - Electromagnetic Compatibility for Industrial-Process Measurement - Part 3	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65		WG4	Rep/Act	Environmental Condn - Electromagnetic Compatibility for Industrial-Process Measurement - Part 5	Resource Standard	Environment	Production
(A2) 1 RR	IEC	TC 65	SC C	WG3	Rep/Act	Interface System for Programmable Measuring Instruments - Part 1	Resource Standard & Transport Control Info/Data	Compatibility	Control
(A2) 1 RR	IEC	TC 65	SC C	WG3	Rep/Act	Interface System for Programmable Measuring Instruments - Part 2	Resource Standard & Transport Control Info/Data	Compatibility	Control
(A2) 1 RR	IEC	TC 65		SWG	Rep/Act	Protection Against an Explosion Hazard when Flammable Gas is Used etc.	Resource Standard	Safety	Production
(A2) 1 RR	IEC	TC 65	SC B		Rep/Act	Standard for Fire Safe Control Valves	Resource Standard	Compatability	Production
(A2) 1 RR	IEC	TC 65	SC B	WG5	Rep/Act	Thermocouples - Part 2 (Amend) - Tolerances	Resource Standard	Compatibility	Instrument
(A2) 1 RR	ISO	TC 184	SC1	WG1?	Rep/Act	Axis and Motion Nomenclature	Resource to Resource	Description	Human Interface
(A2) 1 RR	ISO	TC 184		WG3	Rep/Act	Environmental Conditions for Discrete Parts Manufacturing - Automation Sys and Equip.	Resource to Resource	Environment	Production
(A2) 1 RR	ISO	TC 184	SC1		Rep/Act	Numerical Control of Machines - Symbols	Resource to Resource	Description	Human Interface
(A2) 1 VR	IEC	TC 65	SC B		Rep/Act	Electrical, Pneumatic Chart Recorders for Industrial-Process Control Systems - Part 2	Verify Resource	Performance	Instrument
(A2) 1 VR	IEC	TC 65	SC B		Rep/Act	Evaluating Performance of Valve Positioners for Industrial-Process Control Systems	Verify Resource	Performance, Compatability	Control

(Proc)LevelCell	Orgn	Ctte	SC	WG	Ctte/Doc	Scope of Activity or Standards Doc	Example Standards Areas	Viewpoint	Base Technology
(A2) 1 VR	IEC	TC 65	SC B		Rep/Act	General Methods, Procs for Evaluation of Process Measurement, Control Devices	Verify Resource	Performance	Instrument
(A2) 1 VR	IEC	TC 65	SC B		Rep/Act	Guidance for Inspection, Testing of Transmitters in Industrial-Proc Control Sys - Part 2	Verify Resource	Performance	Instrument
(A2) 1 VR	IEC	TC 65	SC B		Rep/Act	Methods for Evaluating Performance of Instruments with Two or Multistage Output etc.	Verify Resource	Performance,	Control
(A2) 1 VR	IEC	TC 65	SC B		Rep/Act	Standard on Calibration Procedures for Industrial Temperature Sensors	Verify Resource	Performance,	Instrument
(A2) 1 VR	IEC	TC 65	SC B	WG5	Rep/Act	Thermocouples - Part 1(Amend) - Reference Tables	Verify Resource	Performance	Instrument
(A2) 2 DD	IEC	TC 65		WG1	Rep/Act	IEV: Chapter 351 - Automatic Control	Vocabulary	Description	Human Interface
(A2) 2 DD	ISO	TC 184	SC5	WG3	Rep/Act	Industrial Automation Systems - Vocabulary		Description	Human Interface
(A2) 2 DD	ISO	TC 184	SC 5	WG 3	Ctte	Industrial Automation Vocabulary	WG3, Title only	Description	Human Interface
(A2) 2 DD	ISO	TC 184	SC1	WG2	Rep/Act	NC Vocabulary		Description	Human Interface
(A2) 2 DD	ISO	TC 184	SC2	WG1	Rep/Act	Robot Vocabulary		Description	Human Interface
(A2) 2 DD	ISO	TC 184	SC 2	WG 1	Ctte	Terminology and Graphical Representation	Data to Data	Description	Human Interface
(A2) 2 DD	ISO	TC 184	SC 1	WG 2	Ctte	Vocabulary	WG2, Title only	Description	Human Interface
(A2) 2 DR	IEC	TC 65	SC A	WG6	Rep/Act	PLCs - Part 4: User Guidelines	Data for Resource	Operability, Maintainability	Control
(A2) 2 RR	IEC	TC 65		WG4	Rep/Act	Environmental Conditions - Continuous Wave Conducted Immunity Requirements	Resource Standard	Environment	Production