BS ISO 21622-3:2024

BSI Standards Publication

Irrigation techniques — Remote monitoring and control for irrigation

Part 3: Interoperability

Documents
Document Sharing Hub

Full document details: BS ISO 21622-3:2024

National foreword

This British Standard is the UK implementation of ISO 21622-3:2024.

The UK participation in its preparation was entrusted to Technical Committee W/-, Consumer Products and Services Sector Policy and Strategy Committee.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2024
Published by BSI Standards Limited 2024

ISBN 978 0 539 02705 1

ICS 65.060.35

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2024.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

International Standard

ISO 21622-3

First edition
2024-03

Irrigation techniques — Remote monitoring and control for irrigation —

Part 3: Interoperability

Reference number
ISO 21622-3:2024(en)

© ISO 2024

Documents
Document Sharing Hub

Full document details: BS ISO 21622-3:2024

COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Documents
Document Sharing Hub

Full document details: BS ISO 21622-3:2024

Contents

Page

Foreword ... vi
Introduction ... vi
1 Scope ... 1
2 Normative reference ... 1
3 Terms and definitions ... 2
4 Interoperability I: System architecture ... 4
4.1 Levels and components of an interoperable architecture ... 4
4.2 Interface specifications ... 6
5 Interoperability II: exchange of data from irrigation entities ... 20
5.1 General outline ... 20
5.2 Static data of the irrigation entities ... 20
5.3 Structure of an irrigation entity identifier (EntityID) ... 28
5.4 Properties ... 28
5.5 Entity events ... 35
6 Interoperability III: Exchange of data from procedural elements performed in irrigation entities ... 37
6.1 General outline ... 37
6.2 Statuses and actions ... 37
6.3 Types of Operation recipes ... 37
6.4 Types of Unit Procedure recipes ... 56
6.5 Types of Procedure recipes ... 58
6.6 Report ... 59
6.7 Procedural element events ... 62
Annex A (normative) Management interface with SOAP 1.2 ... 64
A.1 Overview ... 64
A.2 Requirements ... 64
A.3 Implementation classes for web services ... 66
A.4 Implementation classes for authorization server ... 87
A.5 WSDL ... 88
Annex B (normative) Subsystem interface with SOAP 1.2 ... 104
B.1 Overview ... 104
B.2 Requirements ... 104
B.3 Implementation classes for web services ... 106
B.4 Implementation classes for authorization server ... 121
B.5 WSDL ... 122
Annex C (normative) Event interface with SOAP 1.2 ... 135
C.1 Overview ... 135
C.2 Requirements ... 135
C.3 Implementation classes for web services ... 137
C.4 Implementation classes for authorization server ... 140
C.5 WSDL ... 140
Annex D (informative) Interoperability test protocol ... 144
D.1 Overview ... 144
D.2 General description ... 144
D.3 IT infraestructure ... 145

AVA Documents
Document Sharing Hub

© ISO 2024 – All rights reserved

Full document details: BS ISO 21622-3:2024

D.4 Test bed description ... 146
D.5 Test procedure ... 148
D.6 Tests over subsystems ... 151
D.7 Tests over coordination brokers ... 235
D.8 Tests over management information systems ... 243
D.9 Tests report ... 245

Annex E (informative) Coordination broker software requirement specifications ... 247
E.1 Overview ... 247
E.2 Data model ... 249
E.3 Minimal functions — Coordination broker ... 255
E.4 Desirable functions ... 259
E.5 Specific requirements ... 267
E.6 Request management ... 285
E.7 Cases of use ... 294

Annex F (normative) Management interface with REST ... 295
F.1 Overview ... 295
F.2 Requirements ... 295
F.3 Implementation method for web services ... 297
F.4 ComplexType definition ... 307
F.5 Implementation methods for authorization ... 321
F.6 WADL ... 322
F.7 ComplexTypeF ... 325

Annex G (normative) Subsystem interface with REST ... 334
G.1 Overview ... 334
G.2 Requirements ... 334
G.3 Implementation method for web services ... 336
G.4 ComplexType definition ... 342
G.5 Implementation methods for authorization ... 353
G.6 WADL ... 354
G.7 ComplexTypeG ... 356

Annex H (normative) Event interface with REST ... 363
H.1 Overview ... 363
H.2 Requirements ... 363
H.3 Implementation methods for web services — NewEvent method ... 364
H.4 ComplexType definition ... 365
H.5 Implementation methods for authorization ... 368
H.6 WADL ... 369
H.7 ComplexTypeH ... 370

Bibliography ... 371

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

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 procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry,* Subcommittee SC 18, *Irrigation and drainage equipment and systems.*.

A list of all parts in the ISO 21622 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Documents
Document Sharing Hub

© ISO 2024 – All rights reserved

Full document details: BS ISO 21622-3:2024

Introduction

The purpose of this document is to allow interoperability between the different elements of an irrigation system that exist side by side in the same installation. The introduction of a standard in irrigation control systems will lead to improvements in irrigation programming practice and establish a clear separation between decision making and decision implementation.

This document establishes the specification and location of communication interfaces to be implemented in order to enable the data exchange on commercial products, as well as its integration in an interoperable architecture.

This document defines the mechanisms to exchange and integrate data from remote monitoring and control systems (RMCS) for irrigation, making it available to any management information system (MIS) with permissions.

A manufacturer can adopt this document in all the described levels or specifically in one of them, implementing only the speficications of application to its product.

— The application of this document to a subsystem (RMCS) involves:

a) the implementation of the architecture defined at Clause 4, including the subsystem and the event interfaces, exclusively with the actions supported by this subsystem. Clauses 5 and 6 are related to the kinds of irrigation entities that can be controlled and/or monitored. Its data will be available to any consumer with permissions that implements the defined interface.

b) the implementation of one of the proposed technologies for the subsystem and the event interfaces. The available implementations are described in the Annexes B or G for subsystem interface, and Annexes C or H for event interface. The developer can use any of these sets (Annexes B and C, or Annexes G and H) to implement this document. The implementation can be validated using the tests for subsystems. included in the Annex D.

— The application of this document to a management information system (MIS) involves:

a) the implementation of the architecture defined at Clause 4, including the management interface, exclusively with the actions supported by this MIS. To access data from a subsystem the MIS requires permissions.

b) the implementation of one of the proposed technologies for the management interface. The available implementations are described in the Annexes A or F. The developer can use any of the two to implement the standard. The implementation can be validated using the tests for MIS. included in the Annex D.

— The application of this document to a coordination broker involves:

a) the implementation of the architecture defined at Clause 4 and all its interfaces.

b) the implementation of the interfaces performed using all the technologies used in the implementation annexes (Annexes A, B, C, F, G and H). The implementations can be validated using the tests for coordination brokers, included in the Annex D.

c) Annex E, defines two sets of functionalities for the development of a coordination broker.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Irrigation techniques — Remote monitoring and control for irrigation systems —

Part 3:
Interoperability

1 Scope

This document establishes requirements for interoperability among systems developed for management and/or control of irrigation facilities. It can be applied under any technological platform and irrigation system, regardless of the water management scheme, with the exception of irrigation mobile machinery, including centre pivots and linear irrigation machines. Due to the dynamic nature of these machines, associated control systems and specific safety requirements, the applicability of exchangeable data for irrigation mechanical move systems was not fully determined at the time of this publication.

This document does not define hardware or software requirements for any of the systems to which it applies. It only concerns externally visible interfaces and places no restriction on the underlying implementations. It has been designed to avoid interference with proprietary solutions subjected to intellectual property. From the point of view of the data exchange, and to guarantee interoperability based on the previous premises, this document defines three communication interfaces (interface with management, interface with events and interface with subsystems) and the architecture to which these interfaces apply. Three levels of architecture has been defined to accommodate these interfaces:

— The Management Level, where any MIS conforming with this document is located. Out of all available data exchange methods, each MIS only implements those required to execute its functionalities.

— The Higher Control Level: coordination. At this level is performed the data integration among RMCS and the access control to it. A software element, called coordination broker, ensures this integration and allows the use of different technologies in its interfaces.

— The Lower Control Level: RMCS. These can also be referred to as irrigation subsystems. The RMCS perform the duties of the irrigation entity(s) under its control.

A coordination broker can be developed as a product by any of these manufacturers or by an independent developer using the standard specifications for this kind of software.

2 Normative reference

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8601, *Data elements and interchange formats. Information interchange — Representation of dates and times*

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
action
application of a *method* (3.7) to exchange data leading to accomplish typical irrigation duties

3.2
coordination broker
message broker pattern aplication responsible for the mapping of irrigation entities, for the collection and consolidation of their data, and for the management of the *procedural elements* (3.13) executed by them

Note 1 to entry: It shall conform with the management, *subsystems* (3.20) and events interfaces.

3.3
interface with events
functional connection that enables the exchange of information about events (according to IEC 62682) between the *coordination broker* (3.2) and the *subsystems* (3.20)

3.4
interface with management
functional connection that enables the exchange of information between MIS applications and the *coordination broker* (3.2)

3.5
interface with subsystems
functional connection that enables the exchange of information between the *coordination broker* (3.2) and the *subsystems* (3.20)

3.6
message broker pattern
architectural software pattern for message validation, transformation and routing

Note 1 to entry: A message broker is a software product designed as an intermediary to facilitate interactions between third-party applications. The message broker can also be called interface engine or integration broker.

3.7
method
mechanisms established for the exchange of data between interoperable systems

3.8
MIS application
computer program aimed at administrative and/or Operational decision-making in the irrigation entities

Note 1 to entry: A MIS is a tool acquired for an organization (like a User Community or an Irrigator) to execute one or more of the following specific functions (This list is descriptive and not restrictive.):

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

— administrative control;

— accounting control;

— maintenance;

— behavior modeling;

— operational management; and

— any other purpose aiming at improving decision-making.

3.9
optional conditioned parameter
parameter (3.12) that can be used once a conditioning parameter of an *action* (3.1) is set up

3.10
optional conditioning parameter
parameter (3.12) set up as a part of an action (3.1), that requires the activation of one or more additional required or *optional conditioned parameters* (3.9)

3.11
optional parameter
parameter (3.12) that is not required but can be activated for an *action* (3.1) without requiring the support of additional parameters

3.12
parameter
basic information contained by an *action* (3.1) in the interfaces

3.13
procedural element
specific application of a recipe in an irrigation entity

3.14
procedural model
representation of the reality used to describe the different parts [*procedural elements* (3.13)] of the process to be performed by the elements included in the physical model

3.15
property
required attribute to define an irrigation entity

Note 1 to entry: Note the difference between a parameter, which characterizes an *action* (3.1), and a property, which characterizes an entity

3.16
required parameter
parameter that shall be included when an *action* (3.1) is set up

3.17
required conditioned parameter
parameter required when an *action* (3.1) is set up including an optional or required conditioning parameter

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

3.18
physical model
representation of the reality used to describe the relations, dependences and hierarchy among the physical assets designed to perform a process

Note 1 to entry: The model is divided in seven levels, being the three upper levels focused on administrative purposes and the four lower levels in the process to be performed.

3.19
standard history
recorded set of values of a *property* (3.15) covering a daily time interval and recorded according to a predefined frequency

3.20
subsystem
term used by RMCS in terms of interoperability

Note 1 to entry: A remote monitoring and control system for irrigation (RMCS), is a set of hardware devices and software programs used to monitor and/or control – according to predefined parameters or user decisions – one or more irrigation entities. Typical components of a RMCS include:

— control software, linking data transmission/acquisition and process control;

— devices controlling or monitoring irrigation entities;

— other intermediate devices required for data integration and/or communication purposes.

4 Interoperability I: System architecture

4.1 Levels and components of an interoperable architecture

4.1.1 General

The levels and components are presented in Figure 1.

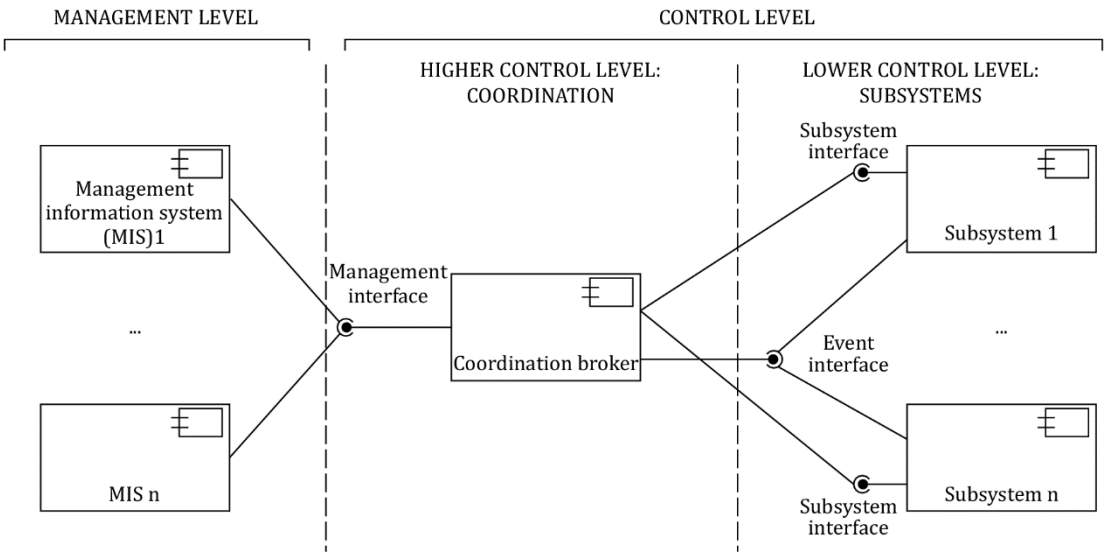

Figure 1 — Levels and components of an interoperable architecture

© ISO 2024 – All rights reserved

Full document details: BS ISO 21622-3:2024

These architecture levels can be used by irrigators or user communities. Both uses the architecture defined in this document to integrate those management tools and subsystems involved in the management and control of his/her/its own property irrigation entities.

However, it is possible to enable other permissions to facilitate the exchange of data with third parties, always with the prior authorization of the data owner.

4.1.2 Control level

The control level comprises:

— the coordination broker; and

— one or more subsystems.

The subsystem interface is established between these two components.

4.1.2.1 Subsystem

The control of an irrigation entity, understood as the acquisition and continuous monitoring of process variables, execution of operations, changes of set points and emergency stops, among others, is always performed at the subsystem level.

4.1.2.2 Coordination broker

The coordination broker performs the following basic functions:

— mapping irrigation entities and their association to the subsystems controlling them;

— establishing an abstraction layer so that MIS applications do not require information on the subsystems responsible for each irrigation entity;

— collecting and consolidating properties, histories, events and procedural elements inherent to irrigation entities;

— coordinating subsystems, providing them with the information they may require, regardless of its origin;

— managing access permissions among the different components integrated in the interoperable architecture; and

— managing the access to irrigation entities and available methods for any component integrated in the interoperable architecture.

4.1.3 Management level

This level comprises all computer applications necessary for the efficient operation of the hydraulic infrastructure, as well as the processes required for the optimum use of water and energy. MIS applications retrieves the data they require from the control level.

The management interface is stablished between the management level and the upper control level.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2 Interface specifications

4.2.1 General

All data exchanged between the architecture levels defined shall be in accordance with the specifications included in this document.

The specifications in this document are not tied to any specific implementation, and only establish the foundations and minimum criteria required to guarantee an effective interoperability performance. The application of this document requires a specific communications protocol at the choice of the manufacturer or developer and adapted to its particular needs. The communication protocol, as well as the security criteria for all the defined interfaces, shall be in accordance with the proposed implementation annexes, Annexes A, B, C for SOAP Web Services or Annexes F, G or H for REST Web Services, depending on the communication protocol selected by the manufacturer.

4.2.2 Data access authorizations

All the interfaces defined in this document shall be secured using authorization systems appropriate for the technology or protocol to be implemented in order to identify the data consumer. The implementation annexes establish the security requirements to be applied in each case.

Any data consumer wishing to use a certain interface shall authenticate itself. The authentication methods to be used for interface access are those described in the implementation annexes.

From its user interface, and in addition to the authorization requirements established, any element of the interoperable architecture (MIS applications, coordination brokers and subsystems) should manage the access permissions for authorized consumers when using its interfaces, allowing:

— the creation of new permissions;

— the deletion of permissions; and

— the modification of this permissions.

This permissions for a data consumer can include access levels restrictions related to:

— the accessible irrigation entities; and

— the allowed methods from those defined for each interface.

Any action not meeting these conditions should be denied.

4.2.3 Irrigation entity identification

The access to any irrigation entity, in all levels of the interoperable architechture, shall be performed using its EntityID, in order to guarantee its univoque identification. This identifier shall be unique among the irrigation entities of an irrigation system.

When introducing or modifiying an irrigation entity, shall be checked that no duplicate irrigation entity identifiers (EntityIDs) exist.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2.4 Common methods to management and subsystem interfaces

4.2.4.1 General

Unless otherwise stated, all defined parameters are required and shall be separated by commas.

4.2.4.2 Writing a property of an entity (Write method)

Table 1 — Input parameters of the Write method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a character string that identifies the action. Generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a character string that corresponds to an irrigation entity. This is a unique ID within the system.
PropertyName	PropertyName	Name of the property on which the action shall be executed.	Contains one of the possible names from the list of entity properties.
Value	string	Value of the property to be written.	Contains a character string with the fields corresponding to the value of the property to be written, separated by commas. Only used for non read-only properties.

Table 2 — Output parameters of the Write method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same parameter included in action input.
Response	string	Response obtained.	Contains two fields separated by commas: Value1, Value2 Where: Value1: closed list of integer numbers identifying the response. Possible values: 0, 1, 2, 3, 4 and 5. Value2: closed list with explanatory texts corresponding to each Value1: If Value1=0, “Action successfully executed”. Generated at recipient. If Value1=1, “Execution error”. Generated at recipient. If Value1=2, “Lexical error”. Generated at recipient. If Value1=3, “Not supported”. Generated at recipient. If Value1=4, “Communication error”. Generated by coordination when communication with reception subsystem is not obtained. If Value1=5, “Coordination error”. Generated by coordination when there is a failure in the

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Output			
Name	**Type**	**Description**	**Specification**
			application. Value2 might be extended using a hyphen with as many explanatory texts as errors can be discriminated by a subsystem or a coordination broker.

Properties admitting Write method are specified for each entity type. The Response shall have Value1=3 when executed on a read-only property (see Table 26).

4.2.4.3 Reading a property of an entity (Read method)

For the reading of the properties, it is the decision of the subsystem if it returns data stored in the database of its control application or if it forces communication with its remote controller(s) or terminal(s).

Table 3 — Input parameters of the Read method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a character string that identifies the action. Generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a character string that corresponds to a irrigation entity. It is a unique ID within the system.
PropertyName	Property Name	Name of the property on which the action shall be executed.	Contains one of the possible names from the list of properties of the entity.

Table 4 — Output parameters of the Read method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	Contains two fields separated by commas: Value1, Value2 Where: Value1: closed list of integer numbers identifying the response. Possible values: 0, 1, 2, 3, 4 and 5. Value2: closed list with explanatory texts corresponding to each Value1: If Value1=0, “Action successfully executed”. Generated at recipient. If Value1=1, “Execution error”. Generated at recipient. If Value1=2, “Lexical error”. Generated at recipient. If Value1=3, “Not supported”. Generated at

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Output			
Name	**Type**	**Description**	**Specification**
			recipient. If Value1=4, “Communication error”. Generated by coordination when communication with reception subsystem is not obtained. If Value1=5, “Coordination error”. Generated by coordination when there is a failure in the application. If Value1=6, “Unavailable”. Generated at recipient for a request about a supported but not in use property. Value2 might be extended using a hyphen with as many explanatory texts as errors can be discriminated by a subsystem or a coordination broker.
Value	string	The value corresponding to the property requested.	Contains a string of fields separated by commas with the value corresponding to the property requested, respecting its format.
TimeStamp	string	Date/time when the read value was generated.	Date when the value was generated at source, using coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm.

4.2.4.4 Reading the standard history of a property (ReadStandHist method)

The preparation of the standard history is performed at the control level. The values included in the standard history represents the ones registered during a natural day, establishing three different number of daily values samples: 24 (hourly sample), 48 (half hourly sample) or 96 (quarter hourly sample). The Response should have Value1=2 in requests for the current day.

Table 5 — Input parameters of the ReadStandHist method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a character string that identifies the action. Generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a character string that corresponds to an irrigation entity. It is a unique ID within the system.
PropertyName	PropertyName	Name of the property on which the action shall be executed.	Contains one of the possible names from the list of properties of the entity.
Date	string	Date for which execution of the action is requested.	Date of the historic values in coordinated universal time (UTC) ISO 8601 format 3.17 MMDDhhmmss±hhmm.
NumHist	integer	Number of samples contained in the daily standard history requested.	The number of samples per day have one of the following values: 24, 48 or 96. The default value is 24.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Input			
Name	**Type**	**Description**	**Specification**
Statistics	string	Name of the statistical variable for which the standard history is generated.	Type of statistical variable for the calculation of the standard history. It contains one of the following listed values: — last — average — minimum — maximum The default value is last.

Table 6 — Output parameters of the ReadStandHist method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Reponse in Table 2.
HistStandard Values	string	The list of values of the standard history, according to the input parameters.	Contains a string of fields separated by commas with the value corresponding to the statistical value requested for the property, respecting its format. Each piece of data contains two fields: value and timestamp of the value at source.

4.2.4.5 Creating a procedural element (CreateRecipe method)

Table 7 — Input parameters of the CreateRecipe method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action. Generated and known by the element executing the method.
ProceduralID	string	ID of the procedural element that is being created via the action.	Contains a string that corresponds to procedural element. It is a unique ID within the system.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to a irrigation entity. It is a unique ID within the system.
EntityType	EntityType	Entity type from those listed.	Type of entity on which the user wishes to execute the action.
RecipeType	RecipeType	Type of procedural element to be created.	Type of procedural element to be created in the irrigation entity identified by EntityID. See operation recipe types in Table 47.
Attending to the selected RecipeType, specific input parameters are required. Optional parameters can also be introduced. The required and optional parameters of all recipe types have been defined in 7.3, 7.4 and 7.5.			

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 8 — Output parameters of the CreateRecipe method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.

The Response shall have Value1=3 – Not supported when the CREATERECIPE method includes:

— one or more optional parameters not supported by the subsystem controlling the irrigation entity; or

— a recipe type not supported by the subsystem controlling the irrigation entity.

4.2.4.6 Stopping a procedural element (StopRecipe method)

Table 9 — Input parameters of the StopRecipe method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action. Generated and known by the element executing the method.
ProceduralID	string	ID of the procedural element that is being stopped by means of the action.	Contains a string that corresponds to the unique ID of the porcedural element to be stopped.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to an irrigation entity. It is a unique ID within the system.

Table 10 — Output parameters of the StopRecipe method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2.4.7 Reading procedural element report (ReadReport method)

Table 11 — Input parameters of the ReadReport method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action. Generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to a irrigation entity. It is a unique ID within the system.
ProceduralID	string	ID of the procedural element for which the report is required.	Contains a string that corresponds to the procedural element. It is a unique ID within the system.
InstanceNumber	integer	Number of the instance of the procedural element for which the report is required.	Contains an integer that corresponds to the operation instance required, being: — 0, to obtain the original operation report. — 1 to n, to obtain the report of an instance of the original operation. If is not specified, the default value is “0”.

Table 12 — Output parameters of the ReadReport method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.
Report	string	Set of data collected with the structure of a report.	Returns the resulting values for a procedural element at the moment of the request. The values shall be separated by commas: The structure of the report shall be in accordance with 6.2. If it is a partial report, the value EndCondition shall be null.
Status	Status	Status of the Procedural element.	Contains one of the values of Table 45.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2.4.8 Reading ID of procedural elements in the subsystem for an entity (ReadProceduralIDs method)

Table 13 — Input parameters of the ReadProceduralIDs method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action. Generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to a irrigation entity. It is a unique ID within the system.
Date	string	Date selected to obtain the ProceduralIDs.	Date in coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm. The date is, by default, that of the current day.
Status	Status	List of possible statuses of a procedural element.	Filter of the status of the procedural elements for which the user wishes to know the ID. Only the values of Table 45. The default value is “Running”.

Table 14 — Output parameters of the ReadProceduralIDs method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.
ProceduralIDs	string	List of IDs of procedural elements.	Contains a string of fields separated by commas with the values corresponding to the proceduralIDs that meets with the input parameterization. Each proceduralID is composed by: value1=proceduralID, value2=number of instance that matchs with the request conditions. If the operation does not have repetitions, value2=0.

4.2.5 Specific methods of the subsystem interface

4.2.5.1 General

The next methods shall be executed from the coordination broker.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2.5.2 Subscription of the coordination broker to the events occurred in an irrigation entity (SubscribeEvent method)

Table 15 — Input parameters of the SubscribeEvent method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action, which is generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to a irrigation entity. It is a unique ID within the system.
Path	string	Path to access to the event server.	Contains the path to enqueue a irrigation entity events.

Table 16 — Output parameters of the SubscribeEvent method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.

4.2.5.3 Unsubscription of the coordination broker to the events occurred in an irrigation entity (UnsubscribeEvent method)

Table 17 — Input parameters of the UnsubscribeEvent method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action, which is generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to an irrigation entity. It is a unique ID within the system.

Table 18 — Output parameters of the UnsubscribeEvent method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table.

4.2.6 Specific actions of the management interface

4.2.6.1 General

The following methods are executed on the coordination broker.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2.6.2 Read IDs of all the irrigation entities (ReadEntityIDs method)

Table 19 — Input parameters of the ReadEntityIDs method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action. Generated and known by the element executing the method.

Table 20 — Output parameters of the ReadEntityIDs method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.
EntityIDs	string	List with all the IDs of the entities known by the coordination broker.	Returns the ID of all the entities, separated by commas, known by the coordination broker.

4.2.6.3 Read static data of an irrigation entity (ReadEntityData method)

Table 21 — Input parameters of the ReadEntityData method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action. Generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to the irrigation entity. It is a unique ID within the system.

Table 22 — Output parameters of the ReadEntityData method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.
StaticData The output obtained contains the complete list of static data with its values, as defined in 6.2. Any value that does not apply to a certain EntityType is returned with a null value.			

The ReadEntityData method allows the MIS applications to build the structure of the hydraulic network.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2.6.4 Reading the ID of procedural elements in the coordination broker for an irrigation entity (GetProceduralIDs method)

Table 23 — Input parameters of the GetProceduralIDs method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action. Generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to an irrigation entity. It is a unique ID within the system.
Date	string	Date selected to obtain the ProceduralIDs.	Date in coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm. The date is, by default, that of the current day.
Status	Status	List of possible statuses of a procedural element.	Filter of the status of the procedural elements for which the user wishes to know the ID. Only the values of Table 45. The default value is “Running”.

Table 24 — Output parameters of the GetProceduralIDs method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.
ProceduralIDs	string	List of IDs of procedural elements that have been filtered by the action.	Contains a string of fields separated by commas with the values corresponding to the proceduralIDs that meets with the input parameterization. Each proceduralID is composed by: value1=proceduralID, value2=number of instance that matchs with the request conditions.

4.2.6.5 Reading the events occurred in an irrigation entity (ReadEvent method)

Table 25 — Input parameters of the ReadEvent method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action, which is generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to a irrigation entity. It is a unique ID within the system.
ProceduralID	string	ID of the procedural element where the user wishes to execute the action.	Contains a string that corresponds to a procedural element. It is a unique ID within the system. The default value is null. If not entered, all events associated with the EntityID are returned.

AVA Documents
Document Sharing Hub

© ISO 2024 – All rights reserved

Full document details: BS ISO 21622-3:2024

Input			
Name	**Type**	**Description**	**Specification**
InitialDate	string	Initial date of the requested history.	Date in coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm.
FinalDate	string	Final date of the requested history.	Date in coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm.

Table 26 — Output parameters of the ReadEvent method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	See Response in Table 2.
EventValues	EventValues	List of events which have taken place in the entity.	Contains a list of one or more events separated by commas, each one with 8 fields also separated by commas. The possible values are listed at Table 27.

All events described in this document, both for entities and for procedural elements, have the definition in the Table 27.

Table 27 — EventValue

Name	Type	Description	Specification
EventID	string	ID of the occurred event.	Contains a string that corresponds to an event ID. It is a unique ID within the subsystem that generates it.
EventName	EventName	Name for a listed event for an entity/procedural element	Contains the event description.
TimeStamp	string	Date/time when the event was generated.	Date when the event was generated at source, using coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm.
Relevance	integer	Relevance of the event. The relevance allows to establish priority routes for its communication if needed.	Contains an integer with the following possible values: — Relevance=0 implies low relevance. — Relevance=1 implies high relevance. This parameter can be configured at each subsystem, responding to user needs.
ProceduralID	string	ID of the procedural element in which the event has occurred.	Contains a string that corresponds to a procedural element. It is a unique ID within the system.
InstanceNumber	integer	Number of the ProceduralID instance to which the event belongs.	Contains an integer that corresponds to the instance of the ProceduralID where the event occurs.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

4.2.7 Specific methods of event interface

4.2.7.1 New event occurred in an irrigation entity (NewEvent method)

Table 28 — Input parameters of the NewEvent method

Input			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Contains a string that identifies the action, which is generated and known by the element executing the method.
EntityID	string	ID of the entity where the user wishes to execute the action.	Contains a string that corresponds to an irrigation entity. It is a unique ID within the system.
EventValue	EventValue	Event which have taken place in the entity.	Contains a list of one or more events separated by commas, each one with 6 fields also separated by commas. The possible values are listed at Table 27

Table 29 — Output parameters of the NewEvent method

Output			
Name	**Type**	**Description**	**Specification**
ActionID	string	ID of the action.	Same element included in action input.
Response	string	Response obtained.	Contains two fields separated by commas: Value1, Value2 Where: Value1: closed list of integer numbers identifying the response. Possible values: 0, 1, 2 and 5. Value2: closed list with explanatory texts corresponding to each Value1: If Value1=0, “Action successfully executed”. Generated at recipient. If Value1=1, “Execution error”. Generated at recipient. If Value1=2, “Lexical error”. Generated at recipient. If Value1=5, “Coordination error”. Generated by coordination when there is a failure in the application. Value2 might be extended using a hyphen with as many explanatory texts as errors can be discriminated by a subsystem or a coordination broker.

4.2.8 Application of the methods on properties

The following restrictions are established on the execution of methods on the set of properties related to the irrigation entities and described in 5.4.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 30 — Application of the methods on properties

Properties	Write	Read	ReadStandHist
ActivityStatus	✓	✓	✓
SystemStatus		✓	✓
Mode		✓	✓
CumulativeVolumeOut	✓	✓	✓
InternalFlowOut		✓	✓
PressureOut		✓	✓
OpeningDegree		✓	✓
Temperature		✓	✓
RelativeHumidity		✓	✓
SolarRadiation		✓	✓
WindParameters		✓	✓
Rainfall		✓	✓
CumulatioveVolumeIn	✓	✓	✓
InternalFlowIn		✓	✓
PressureIn		✓	✓
InstantPower		✓	✓
EnergyConsumption		✓	✓
EntityPerformance		✓	✓
PowerOnTime		✓	✓
SoilWaterPotential		✓	✓
SoilWaterContent		✓	✓
SoilTemperature		✓	✓
SoilConductivity		✓	✓
WaterAcidity		✓	✓
WaterConductivity		✓	✓
DifferentialPressure		✓	✓

The rest of methods are not applicable to properties, but to irrigation entities or to procedural elements, so that:

— ReadEvent, CreateRecipe, StopRecipe, ReadProceduralIDs and ReadEntityData methods only apply to irrigation entities through EntityID;

— ReadReport method only applies to procedural elements through ProceduralID;

— ReadEntityIDs method only applies to the coordination broker.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

5 Interoperability II: exchange of data from irrigation entities

5.1 General outline

The first part of exchangeable data is associated to the irrigation entities included in the physical model of this document. Table 31 summarizes the entities included in this document. These entities are characterized by a set of properties, static data and events. The static data are related to issues as identification, location, communication, design and historical data to be introduced by the user for management purposes. Among others, the data exchange allows to:

— obtain standardized data from an irrigation entity;

— execute certain actions over these entities;

— monitor their statuses;

— obtain historical data; and

— generate events related.

Table 31 — Irrigation entities of the physical model

Entity name	Acronym	Level	Entity name	Acronym	Level
Sector	IRA	Process cell	Simple irrigation hydrant	HYS/SIH	Equipment module
Pumping station	PMS	Unit	Virtual irrigation hydrant	VIH	Equipment module
Reservoir	RSV	Unit	Irrigation hydrant group	IHG	Equipment module
Irrigation network	INT	Unit	Manual irrigation hydrant	MIH	Equipment module
Solid-set irrigation system	SSS	Unit	Irrigation block	SSB	Equipment module
Fertigation station	FTS	Unit	Dosing module	DSM	Equipment module
Water filtration station	WFS	Unit	Fertilizer tank	FRT	Equipment module
Pumping line	PML	Equipment module	Dilute tank	DLT	Equipment module
Network control point	NCP	Equipment module	Filtering line	FTL	Equipment module
Network branch	NBU	Equipment module			

5.2 Static data of the irrigation entities

5.2.1 General

All irrigation entities have the static data, given in Table 32, for their complete and univocal identification.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 32 — Static data of the irrigation entities

Field	Type	Description	Applies to
Identification			
EntityID	string	Unique ID of the entity. It is a unique ID within the system.	All
EntityLevel	EntityLevel	Level of the physical model to which the entity belongs (Table 34 – EntityLevel).	All
EntityType	EntityType	Entity type from those listed in the physical model (Table 35 – EntityType).	All
ControlLevel	ControlLevel	Identification of the control level that is responsible for the irrigation entity between the ones defined in the architecture (Table 36 – ControlLevel).	All
Location			
SpatialData	string	UTM coordinates where the entity is located with the EPSG code associated. The coordinates uses the detailed specification available on 6.2.2.	All
PrecursorEntities	string	Entities that occupy the same level in the physical model and that are the origin of the water received by the entity. See specifications at 6.2.3.	All
SuccessorEntities	string	Entities that occupy the same level in the physical model and that are the destination of the water supplied by the entity. See specifications at 6.2.3.	All
ChildEntities	string	All the lower level entities that comprise the entity according to the physical model.	All
ParentEntity	string	Higher level entity that contains the entity, according to the physical model.	All
Communication			
Path	string	Path to access to the subsystem.	All
CommProtocol	CommProtocol	Communication protocol used by the subsystem controlling the entity (Table 37).	All
Design			
InternalFlowOut	boolean	Informs about whether the extended property exists and is supported y the irrigation entity.	HYS, VIH, MIH, NBU, INT, SSS and NCP
PressureOut	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, NBU, INT, SSS and NCP
DesignPressure	integer	Design pressure of the entity, expressed in Pa.	HYS, VIH, MIH, IHG, NBU, INT, PMS,

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Field	Type	Description	Applies to
			PML,SSB, FTS, WFS and FTL.
DesignFlowRate	decimal	Design flow rate of the entity, expressed in m^3/s.	HYS, VIH, MIH, IHG, NBU, INT, PMS, PML,SSB, FTS, WFS and FTL.
Caliber	integer	Caliber of the entity, expressed in m.	HYS, VIH, MIH, NCP
Temperature	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
RelativeHumidity	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
SolarRadiation	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
WindParameters	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
Rainfall	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
CumulativeVolumeOut	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	RSV and NCP
CumulativeVolumeIn	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	IHG, NBU, INT, PMS and NCP
InternalFlowIn	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	IHG, NBU, INT, PMS and NCP
PressureIn	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	IHG, NBU, INT, PMS and NCP
SoilWaterContent	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
SoilWaterPotential	boolean	Informs about whether the extended property exists and is supported by the	HYS, VIH, MIH, IHG,

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Field	Type	Description	Applies to
		irrigation entity.	PMS, RSV, SSS and NCP
SoilTemperature	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
SoilConductivity	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	HYS, VIH, MIH, IHG, PMS, RSV, SSS and NCP
Behavior	Behavior	Contains one of the values established by defining the expected behavior of the entity in Table 37.	IHG
DesignSimultaneity	integer	Design simultaneity for the entities contained by the entity. This parameter is expressed as a percentage, from 0 to 100, without decimals, referring to the maximum number of outlets that can be simultaneously active. In case the value of the admissible simultaneous outputs does not correspond to an integer number, it should be rounded down.	NBU, INT and SSS
DesignPower	integer	Design power of the entity, expressed in W.	PMS, PML, FTS and WFS.
DesignCapacity	integer	Design volume capacity of the entity, expressed in m^3.	RSV
DesignAutonomy	integer	Design autonomy of the water supply without inputs, expressed in days.	RSV
ActivityStatus	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	NCP, INT and NBU
SystemStatus	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	NCP, INT and NBU
Mode	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	INT and NBU
OpeningDegree	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	NCP
InstantPower	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	PMS, PML
EnergyConsumption	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	PMS, PML
EntityPerformance	boolean	Informs about whether the extended property exists and is supported by the	PMS, PML

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Field	Type	Description	Applies to
		irrigation entity.	
PowerOnTime	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	PML
Capacity	boolean	Informs about whether the extended property exists and is supported by the irrigation entity.	PMS
Area	integer	Irrigation surface covered, expressed in m^2.	SSS and SSB
Historical			
MeterReplacementEvent	string	Contains three fields separated by comas for each reported replacement, where — value1: Installation date in coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm. — value2: Old meter reading at the time of replacement, m^3. — value3: New meter reading at the time of replacement, m^3.	HYS, VIH, MIH, IHG and NCP
PowerOnTimeCounterStart	string	Start date of the PowerOnTime property counting. In coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm.	PMS and PML
EnergyMeterCounterStart	string	Start date of the energy meter device counting. In coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm.	PMS
InjectorNumber	integer	Number of injectors existing in the entity, expressed in units.	FTS
DesignCapacity	integer	Design volume capacity of the entity, expressed in m^3.	RSV, FRT and DLT
DesignAutonomy	integer	Design autonomy of the water supply without inputs, expressed in days.	RSV, FRT and DLT
FertigationMethod	FertigationMethod	Fertigation method used at the entity (Table 39).	FTS
FiltrationDegree	integer	Design filtration degree of the entity, expressed in µm.	WFS and FTL
MaxWorkingPressure	real	Maximum pressure for adecuate entity functioning, expresed in Pa.	WFS
MinWorkingPressure	real	Minimum pressure for adecuate entity functioning, expresed in Pa.	WFS

These data shall be accessible from MIS applications through the ReadEntityData method. The next tables provide the list of values of all enumerated parameters defined.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 33 — EntityLevel

List of values
Empty
ProcessCell
Unit
EquipmentModule

Table 34 — EntityType

List of values				
IRA	PMS	INT	RSV	SSS
PML	HYS	SSB	NCP	IHG
VIH	MIH	NBU	FTS	DSM
FRT	DLT	WFS	FTL	Empty

It is foreseen that additional irrigation entities (EntityType) can be included in this document as soon as their functional characterization is completely designed and tested.

Table 35 — ControlLevel

List of values
HigherControlLevel
LowerControlLevel

Table 36 — CommProtocol

List of values
Empty
SOAP12
REST

Table 36 can be expanded with new communication protocols in future versions.

Table 37 — Behavior

List of values
Empty
Behavior1
Behavior2

Two possible behaviors, related to IHG irrigation entities, are established:

— Behavior1. The IHG applies restrictions, not allowing simultaneous operations in the VIHs contained by it.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

— Behavior2. The IHG applies restrictions, not allowing non simultaneous operations in the VIHs contained by it.

Table 38 — FertigationMethod

List of values
InLineInjection
DilutionTank

5.2.2 SpatialData specification

The spatial representation of any irrigation entity follows the Well-Known Text (WKT) format of the Open Geospatial Consortium (OGC). The representation system uses UTM coordinates, with European Petroleum Survey Group (EPSG). The SpatialData definition contains two fields, separated by commas:

— Field 1: EPSG code represented by five figures to define the entity's Coordinate Reference System.

— Field 2: entity coordinates, attending to WKT format definition for "POINT Z", "LINESTRING Z" and "POLYGON Z" geometries. The entity coordinates have: seven figures and three decimal for X coordinate, nine figures and three decimal for Y coordinate and four figures and three decimal for Z coordinate. All decimals shall be separated by a point.

The level of detail with which an irrigation entity is located is defined by the user when entering its coordinates, bearing in mind that the basic intention of the spatial data is to provide guidance on shape and location. The geometries proposed in Table 39, can be modified by the user as needed.

Table 39 — Geometries for irrigation entities

Entity name	Acronym	Geometry
Sector	IRA	Polygon
Pumping station	PMS	Point
Reservoir	RSV	Polygon
Irrigation network	INT	Polygon
Solid-set irrigation system	SSS	Polygon
Fertigation station	FTS	Point
Water filtration station	WFS	Point
Pumping line	PML	Point
Network control point	NCP	Point
Network branch	NBU	Polygon
Simple irrigation hydrant	HYS/SIH	Point
Virtual irrigation hydrant	VIH	Point
Irrigation hydrant group	IHG	Point
Manual irrigation hydrant	MIH	Point
Irrigation block	SSB	Polygon
Dosing module	DSM	Point
Fertilizer tank	FRT	Point

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Entity name	Acronym	Geometry
Dilute tank	DLT	Point
Filtering line	FTL	Point

5.2.3 Topological data specification

5.2.3.1 General

The topological data of the irrigation entities is obtained from its PrecursorEntities and SuccessorEntities static data. Due to the equipment module level recursivity, the following entity types does not have topological information:

— Network branch (NBU).

5.2.3.2 Unit level

Table 40 — Topological data at the unit level

Field	Type	Description
Location		
PrecursorEntities	string	Contains the EntityIDs of all entities that occupy the same level in the physical model and that are the origin of the water received by the entity.
SuccessorEntities	string	Contains the EntityIDs of all entities that occupy the same level in the physical model and that are the destination of the water supplied by the entity.

Certain units can be the water source, so the requirement for a precursor does not apply to PMS and RSV irrigation entities.

Other units can be the water final destination, so the requirement for a successor does not apply to INT and SSS irrigation entities.

5.2.3.3 Equipment module level

Table 41 — Topological data at the equipment module level

Field	Type	Description
Location		
PrecursorEntities	string	Contains four fields for each precursor entity. The fields are separated by comas where: — value1: EntityID of the precursor entity. — value2: Connection length, expressed in metres, between the entity and its precursor entity. — value3: Connection diameter caliber, expressed in metres, between the entity and its precursor entity. — value4: Connection material, expressed in technical acronyms (PRFV, PVC, PEAD, steel, iron, concrete or any other material).

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Field	Type	Description
Location		
SuccessorEntities	string	Contains four fields for each successor entity. The fields are separated by comas: — value1, value2, value3, value 4 Where: — value1: EntityID of the successor entity. — value2: Connection length, expressed in metres, between the entity and its successor entity. — value3: Connection diameter caliber, expressed in metres, between the entity and its successor entity. — value4: Connection material, expressed in technical acronyms (PRFV, PVC, PEAD, steel, iron, concrete or any other material).

Certain equipment modules can be the water source, so the requirement for a precursor not applies to NCP and PML irrigation entities.

Other equipment modules shall be the water final destination, so the requirements for a successor do not apply to HYS, MIH, VIH and SSB irrigation entities.

The construction of the hydraulic topology based on the precursor-successor relationships works properly to indicate the water direction in dendritic topology but has limitations for its use in mesh topology, in which the water direction can change. In this case,the water direction shall be selected in order to define the topology to be used.

5.3 Structure of an irrigation entity identifier (EntityID)

The ID of an irrigation entity shall be unique at this level and should be composed by the IDs of the upper level irrigation entities to which it belongs. The IDs shall respect the structure given in Table 42.

Table 42 — Structure of the EntityID

Name	Specification
Process cell ID	String formed by the value of the Table 34 corresponding to the entity at the process cell level of the physical model, followed by a three-figure number sequence.
Unit ID	String taken by the process cell ID containing the unit, followed by the code of the Table 34 corresponding to the entity, followed by a three-figure number sequence.
Equipment module ID	String taken by the process cell ID and the ID unit containing the equipment module, followed by the code of the Table 34 corresponding to the element at the equipment module level and by a three-figure number sequence. This ID admits recurrence with other equipment module IDs.

5.4 Properties

The properties contains, at least, the following information:

— value; and

— date on which that value was read (timestamp in coordinated universal time (UTC) ISO 8601 basic format YYYYMMDDhhmmss±hhmm).

Since the unit of measurement for the expression of all these properties is explicitly specified in this document, only the values are exchanged.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 43 can be extended with additional properties, according to the needs of the entities to be included in the physical model. Additional properties can be included in this document when their functional characterization are completed.

Table 43 — Properties specification and application

PropertyName	Description	Unit (S.I.)	Specification	Required for	Extended for
ActivityStatus	Status presented by an irrigation entity at the current moment.	N/A	Contains two fields separated by commas: value1, value2 Where: value1: indicates whether the entity is available to execute its functions. It may take one of the following listed values: — Active (introduced by user) — Inactive (introduced by user) value2: indicates the substatus of the entity. It may take one of the following listed values: — OutOfOrder (introduced by subsystem or user) — Unknown (introduced by subsystem) — Ready (introduced by subsystem or user) The following scenarios shall be taken into account: 1. If the entity receives the request to modify the ActivityStatus property to Inactive value when a procedural element is being executed, it stops, going to Stopped status. The corresponding event shall be generated and also the report of the executed irrigation. Once finished, the ActivityStatus property is set to Inactive. 2. If the entity receives a request for the execution of a new procedural element when it is in Inactive status, the response shall be in all cases a 1 - Execution error. 3. If a procedural element has been sent before inactivating the irrigation entity, its execution should be viable as long as its start condition is not reached and it is verified that the entity is still in the Inactive status. Once the start condition is reached (or the time end condition in a subsystem that supports partial executions), the procedural element shall pass to Stopped status. 4. If the procedural element previosly received contains repetitions or is based on calendar, its management shall be the same as described in point 3, but for each one of its instances. That is, several instances could pass to Stopped directly and later, others could be executed because the status of the irrigation entity has changed to Active before its start condition has been reached.	HYS, VIH, IHG, PMS, RSV, SSS, MIH, FTS and FTL.	INT, PML, NBU, SSB, NCP and FTL.
SystemStatus	Status presented	N/A	Contains seven fields, separated by commas, that identify the current state of the subsystem device	HYS, VIH, IHG, PMS,	INT, PML, NBU and

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

PropertyName	Description	Unit (S.I.)	Specification	Required for	Extended for
	by the control system controlling or monitoring the irrigation entity at the current moment.		controlling the irrigation entity: value1, value2, value3, value4, value5, value6, value7. Where: value1: number, with a decimal point, corresponding to the accumulator voltage expressed in volts (V). value2: percentage from 0 to 100, with a decimal point, referring to the remaining charge of the accumulator. This value is determined by the subsystem and is expressed as a percentage (%). If the subsystem does not perform this calculation, this field takes the value "Not supported". value3: number, with a decimal point, which corresponds to the register of the signal strength (Radio Signal Strength), expressed in decibels per milliwatt (dBm). If this data is not available, this field takes the value "Not supported". value4: associated to value3, listed value that corresponds to the expression of the signal strength, in terms interpretable by the user. The following range of possible values shall be used, being the relation with the dBm performed by subsystem: — Very good: excellent signal strength. — Good: good signal strength. — Fair: adequate signal strength. — Poor: poor signal strength. — Very poor: very poor signal strength. value5: percentage from 0 to 100, with a decimal point, corresponding to the percentage (%) of successful communications in relation to the total of registered communications. If this data is not available, this field takes the value "Not supported". Fields value3 and value4 can be complementary or alternative to value5. That is, every subsystem shall support values 3 and 4 or, alternatively, value 5. value6: UTC date recorded by the device clock, using ISO 8601 format YYYYMMDDhhmmss±hhmm. If no clock is available, this field takes the value "None". value7: UTC date, using ISO 8601 format YYYYMMDDDhhmmss±hhmm on which value6 has been recorded or, if it does not exist (value6 is "None"), the current date in the subsystem. If the subsystem is not working properly due power or communication events, values 1, 2, 3, 4, 5, 6 and 7 takes by default the value "Unknown".	RSV, SSS, MIH, FTS and FTL.	NCP.
Mode	Current functioning mode of the irrigation	N/A	Contains one field: value1 Where:	HYS, VIH, IHG, PMS, RSV, SSS, MIH, FTS	INT, NBU and NCP.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

PropertyName	Description	Unit (S.I.)	Specification	Required for	Extended for
	entity.		value1: indicates the current functioning mode of the entity considered. It may take one of the following listed values: — OnDemand — Programmed — Monitoring (when no other type of procedural element are in running status) The value 1 are related to the type of procedural element in execution at the entity.	and FTL.	
CumulativeVolumeOut	Current value of volume registered by the irrigation entity in its outputs.	m^3	Contains one field: value1 Where: Value1: number with a decimal point containing the cumulative volume delivered since the date when the totalizer device was installed (MeterReplacementEvent static datum).	HYS, IRA, VIH, IHG, PMS, INT, SSS, NBU, MIH and FTS.	RSV, NCP and DSM.
InternalFlowOut	Current value of flow registered by the irrigation entity in its outputs.	m^3/s	Contains one field: value1 Where: value1: number, with a decimal point, that contains the flow delivered by the entity.	PMS and FTS.	HYS, IRA, VIH, IHG, INT, RSV, SSS, NBU, NCP, MIH and DSM.
PressureOut	Current value of pressure registered by the irrigation entity in its outputs.	Pa	Contains one field: value1 Where: value1: number, with a decimal point, that contains the output pressure of the specified entity.	PMS, FTS and WFS.	HYS, VIH, IHG, INT, SSS, NBU, NCP, MIH, DSM and FTL.
OpeningDegree	Property containing information referring to the position of a shut-off device.	%	Contains one field: value1 Where: value1: percentage, from 0 to 100, with a decimal point, referring to the position (from completely open -100 and completely closed – 0) of the shut-off element of the irrigation entity.	HYS, VIH, IHG and SSS.	INT, NBU and MIH.
Temperature	Air temperature registered at the entity.	°C	Contains one field: value1 Where: value1: air temperature.		HYS, IHG, PMS, RSV, SSS, NCP and MIH.
RelativeHumidity	Air relative humidity registered at the entity.	%	Contains one field: value1 Where: value1: relative humidity of the air.		HYS, IHG, PMS, RSV, SSS, NCP and MIH.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

PropertyName	Description	Unit (S.I.)	Specification	Required for	Extended for
SolarRadiation	Solar radiation registered at the entity.	W/m^2	Contains one field: value1 Where: value1: solar radiation.		HYS, IHG, PMS, RSV, SSS, NCP and MIH.
WindParameters	Wind speed and direction registered at the entity.	m/s, deg	Contains two fields separated by commas: value1, value2 Where: value1: wind speed. Value2: wind direction.		HYS, IHG, PMS, RSV, SSS, NCP and MIH.
Rainfall	Rainfall registered at the entity.	$m^3/m^2/s$	Contains one field: value1 Where: value1: Cumulative volume of rain water.		HYS, IHG, PMS, RSV, SSS, NCP and MIH.
CumulativeVolumeIn	Current value of volume registered by the irrigation entity in its inputs.	m^3	Contains one field: value1 Where: value1: number with a decimal point containing the cumulative volume received since the date when the totalizer device was installed.	IRA, IHG, INT and FTS.	PMS, RSV, NBU, SSS and NCP.
InternalFlowIn	Current value of flow registered by the irrigation entity in its inputs.	m^3/s	Contains one field: value1 Where: value1: number, with a decimal point, that contains the flowreceived by the entity.	FTS	IRA, IHG, PMS, INT, RSV, NBU and NCP.
PressureIn	Current value of pressure registered by the irrigation entity in its inputs.	Pa	Contains one field: value1 Where: value1: number, with a decimal point, that contains the output pressure of the entity.	INT, FTS and WFS.	IHG, PMS, NBU, NCP, DSM and FTL.
InstantPower	Current amount of power absorbed by the entity during the execution of its functionalities.	W	Contains one field: value1 Where: value1: number, with a decimal point, that contains the absorbed instant electric power by the entity.	PMS	PML, FTS and WFS.
EnergyConsum	Entity	Ws,	Contains two fields:	PMS	FTS and

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

PropertyName	Description	Unit (S.I.)	Specification	Required for	Extended for
ption	energy consumption.	VArs	value1, value2 Where: value1: number, with a decimal point, corresponding to the active energy consumed by the entity since the date when the counting at the energy meter device was started (EnergyMeterCounterStart static datum). Value2: number, with a decimal point, corresponding to the reactive energy consumed by the entity since the date when the counting at the energy meter device was started (EnergyMeterCounterStart static datum).		WFS.
EntityPerformance	Entity hydraulic performance .	%	Contains one field: value1 Where: value1: percentage, from 0 to 100, with a decimal point corresponding to the entity performance during the execution of its functionalities. This property is obtained via the properties given in Formula (1): $E_{\mathrm{P}}(\%) = \left[\frac{9804{,}14 x F_{\mathrm{out}} x (P_{\mathrm{out}}/9804{,}14)}{I_{\mathrm{power}}}\right]$ (1) E_{p} = Entity Perform F_{out} = Internal flow out P_{out} = Pressure out I_{power} = Instant power	PMS	
PowerOnTime	Entity accumulated activity time.	s, N/A, s	Contains three fields: value1, value2, value3 Where: value1: number, with a decimal point, corresponding to the accumulated time since the date when the PowerOnTimeCounter was started. Value2: integer corresponding to the number of times that the entity has been executing its functionalities. Value3: number, with a decimal point, corresponding to the accumulated time on which the entity has been in ActivityStatus Unknown and/or OutofOrder.	PMS, FTS and WFS	PML, DSM and FTL.
Capacity	Volume contained by the entity.	m^3, %	Contains two fields: value1, value2 Where: value1: number with a decimal point, containing the current volume contained by the entity. Expressed in cubic metres. Value2: percentage, from 0 to 100 with a decimal point, corresponding to the quotient between the value1 and the DesignCapacity static datum.	RSV	NCP, PMS, FRT and DLT.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

PropertyName	Description	Unit (S.I.)	Specification	Required for	Extended for
SoilWaterContent	Water contained by the soil linked to the entity in a reference area.	%, string	Contains from two to n fields, grouped in pairs. Each pair corresponds to a reference area existing in the entity: (value1, value2),(value n-1,value n) Where: value1: percentage, from 0 to 100 with a decimal point, corresponding to the water volume contained in the soil porosity. Value2: string with the geographical location of the value1 with its internal fields separed by commas. The content of value 2 uses the spatial data information defined on 6.2.1 for point geometry entities.		HYS, IHG, NCP, MIH and SSB.
SoilWaterPotential	Energy state of water in the soil linked to the entity in a reference area.	Pa, string	Contains from two to n fields, grouped in pairs. Each pair corresponds to a reference area existing in the entity: (value1, value2),(value n-1,value n) Where: value1: number with a decimal point, containing the current water retaining potential of the soil. Value2: string with the geographical location of the value1 with its internal fields separed by commas. The content of value 2 uses the spatial data information defined on 6.2.1 for point geometry entities.		HYS, IHG, NCP, MIH and SSB.
SoilTemperature	Temperature in the soil linked to the entity in a reference area.	°C, string	Contains from two to n fields, grouped in pairs. Each pair corresponds to a reference area existing in the entity: (value1, value2),(value n-1,value n) Where: value1: number with a decimal point, containing the current temperature of the soil. Value2: string with the geographical location of the value1 with its internal fields separed by commas. The content of value 2 uses the spatial data information defined on 6.2.1 for point geometry entities.		HYS, IHG, NCP, MIH and SSB.
SoilConductivity	Conductivity in the soil linked to the entity in a reference area.	S/m, string	Contains from two to n fields, grouped in pairs. Each pair corresponds to a reference area existing in the entity: (value1, value2),(value n-1,value n) Where: value1: number with a decimal point, containing the current conductivity of the soil. Value2: string with the geographical location of the value1 with its internal fields separed by commas. The content of value 2 uses the spatial data information defined on 6.2.1 for point geometry entities.		HYS, IHG, NCP, MIH and SSB.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

PropertyName	Description	Unit (S.I.)	Specification	Required for	Extended for
WaterAcidity	Acidity value of the water.	N/A	Contains one field: value1 Where: value1: number, with a decimal point, containing the pH of the water.	FTS	
WaterConductivity	Electrical conductivity of the water.	S/m	Where: value1: number, with a decimal point, containing the current conductivity of the water. Expressed in S/m.	FTS	
DifferentialPressure	Pressure diference between the entity inlet and output.	Pa	Contains one field: value1 Where: Value1: number with a decimal point containing the pressure difference between the entity inlet and output. Expressed in pascals.	WFS	FTL

The properties in use vary with the irrigation entity modeled. It is required to take into account the properties defined as required or extended for each irrigation entity in the table. A number of these properties are common between entities. Additional entities may require properties which have not yet been defined.

Each subsystem controlling an irrigation entity shall support its required properties defined in Table 43. Additionally, for extended properties, and taking into account that can be implemented or not, the subsystem responds to one of the following situations.

— The property is supported and in use. The subsystem shall return its value as defined in Table 43.

— The property is supported by the subsystem but non-existent in the irrigation entity. The subsystem shall generate the message “Unavailable” when the value of such property is requested.

— The property is not supported by the subsystem. The subsystem shall generate the message “Not supported” when the value of such property is requested.

5.5 Entity events

The specification of events for all irrigation entities is presented in Table 44, where are only included the events related to the entity. Table 79 includes the events related to procedural elements.

In those events where EventName-Field2 is defined as Active/Inactive, the value Active should be understood as corresponding to the activation (or starting) of the event and the value Inactive as corresponding to the deactivation (or ending) of the event. Thus, to generate the event with Inactive value in field 2, it is required that previously has had Active value, always occurring the inactivation after the activation. Note that the listed events can be extended with new events and with the development of additional entities.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 44 — EventName

EventName-Field1	EventName-Field2	EventName-Field3	Description	Applies to
ActivityStatusChanged	Previous value	Current value	The ActivityStatus property changes its value.	All entities
SystemStatusUnknown			The SystemStatus property changes its value to unknown.	PMS, RSV, SSS, FTS, WFS, NCP, HYS, VIH, IHG and MIH
ModeChanged	Previous value	Current value	The Mode property changes its value.	All entities
InternalFlowOutIsNot0OpeningDegreeIs0	Active/Inactive		Activation/deactivation of flow other than zero with entity closed event.	HYS and VIH
GeneralFailure	Active/Inactive		Activation/deactivation of a general failure in an unit entity. The entity is not available when the event is active.	PMS, RSV, FTS and WFS
Failure	Active/Inactive		Failure in on status in an equipment module entity. The entity is not available when the event is active.	PML, NCP, NBU, DSM and FTL.
CumulativeVolumeOutSync	Previous value	Current value	The CumulativeVolumeOut property has been synchronized.	All entities
MinimumCapacity	Active/Inactive	Current value	Activation/deactivation of minimum level reached on a source entity. Related to Capacity property.	RSV, FRT and DLT
MaximumCapacity	Active/Inactive	Current value	Activation/deactivation of maximum level reached on a destination entity. Related to Capacity property.	RSV, FRT and DLT
CumulativeVolumeIn≠CumulativeVolumeOut			The CumulativeVolumeOut and CumulativeVolumeIn properties, has not the same value (±5 %).	INT, NBU and IHG
ContinuosCleaning	Active/Inactive		Activation/deactivation of a failure on in filter flushing.	WFS and FTL
MaxWorkingPressure	Active/Inactive		Activation/deactivation of maximum working pressure detected.	WFS
MinWorkingPressure	Active/Inactive		Activation/deactivation of minimum working pressure detected.	WFS
AutonomyWarning	Active/Inactive	Remaining autonomy (voltage)	Activation/deactivation of an event: the energy autonomy of the irrigation entity is near to end.	All entities
AccessWarning	Active/Inactive		Activation/deactivation of a warning of physical access to the irrigation entity.	All entities
SubsystemEvent	Available to define	Available to define	Open event for proprietary events of a subsystem.	All entities
AccumulativePropertySync	Previous value	Current value	The value of a accumulative property has been synchronized.	All entities

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

6 Interoperability III: Exchange of data from procedural elements performed in irrigation entities

6.1 General outline

The second part of exchangeable data is associated to the processes performed by the irrigation entities included in the physical model of this document. These processes are identified in the procedural model in this document. Among others, the data exchange allows to:

— generate procedural elements for an irrigation entity;

— execute actions over these procedural elements;

— monitor their statuses;

— generate events related; and

— obtain partial and final reports.

All the elements described in the procedural model contains the necessary information to characterize their status when requested. In certain status a procedural element may not accept the execution of actions over it.

6.2 Statuses and actions

This document defines five basic statuses for the procedural elements.

Table 45 — Procedural elements statuses

Status	Description
Idle	Initial status. Awaiting a start condition.
Running	The start condition has been reached; the programmed tasks are being performed.
Stopped	The procedural element has been detained by means of a request for stopping.
Completed	An end condition has been reached and it is finished.
Unknown	The status is not known at the moment of the request.

The actions available to be applied to the procedural elements are included in Table 46.

Table 46 — Actions available in each status

	Idle	Running	Stopped	Completed
StopRecipe	YES	YES	NO	NO

6.3 Types of Operation recipes

6.3.1 General

According to the types of irrigation entities, the Operation recipe types are defined in Table 47.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 47 — Operation recipes

Operation recipe type (RecipeType)	Description	Applicable to	Property Mode value
IrrigationRecipe1	Supply of water (or irrigation) by time or volume.	HYS, IHG/VIH and SSS	Programmed
IrrigationRecipe2	Supply of water (or irrigation) without end condition.	HYS	OnDemand
IrrigationRecipe3	Supply of water (or irrigation) based on a calendar and executions by time or volume.	HYS, IHG/VIH and SSS	Programmed
IrrigationRecipe4	Supply of water (or irrigation) based on thresholds.	HYS and SSS	Programmed
PumpingRecipe1	Pumping of irrigation water according to a flow rate set point.	PMS	Programmed
PumpingRecipe2	Pumping of irrigation water according to flow rate and level set points, typically related to RSV.	PMS	Programmed
PumpingRecipe3	Pumping of irrigation water according to a pressure set point, typically required by a INT.	PMS	OnDemand
PumpingRecipe4	Pumping of irrigation wate according to flow rate and pressure set points, typically required by a INT.	PMS	OnDemand
PumpingRecipe5	Pumping of irrigation water attending to time habilitation.	PMS	Programmed
NetworkBranchRecipe1	Procedure of water delivering to one or more recipients, guaranteeing the presure and flow requirements.	NBU	N/A
ControlPointRecipe1	Programming of a control point for safety and maintenance purposes.	NCP	N/A
ControlPointRecipe2	Programming of a control point to provide specific flow rate or pressure downstream the irrigation entity.	NCP	Programmed
ControlPointRecipe3	Programming of a control point to monitorize one or more properties of the irrigation entity.	NCP	Monitoring
FertigationRecipe1	Addition of fertilizers to the irrigation water by injection of a proportional quantity of fertilizer to a volume of irrigation water.	FTS	Programmed
FertigationRecipe2	Addition of fertilizers to the irrigation water by injection of a proportional quantity of fertilizer throughout the Operation.	FTS	Programmed
FertigationRecipe3	Addition of fertilizers to the irrigation water by injection of a bulk of fertilizer based on a time criteria during the Operation.	FTS	Programmed
FertigationRecipe4	Addition of fertilizers to the irrigation water by injection of a bulk of fertilizer based on a volume criteria during the Operation.	FTS	Programmed
FertigationRecipe5	Addition of a premixed fertilizer to the irrigation water.	FTS	Programmed

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Operation recipe type (RecipeType)	Description	Applicable to	Property Mode value
FiltrationRecipe1	Physical treatment of irrigation water to reduce the amount of solid particles present.	WSF	Programmed

Note that the Operation recipes described in Table 47 can be extended to response to the needs of the irrigation entities to be included in this document.

6.3.2 Parameterization of header

All the parameters described in the header of an Operation recipe are required.

Table 48 — Generic parameter of the header of an Operation recipe

Header		
Name of parameter	**Type of parameter**	**Description**
ProceduralID	string	Unique ID of a procedural element.
EntityID	string	Unique ID of the entity for which the Operation is intended.
RecipeType	RecipeTtype	Recipe type, as described in Table 47.

6.3.3 Formula parameterization (common parameters) for irrigation Operations

Table 54 presents the formula parameters that are common to all irrigation Operations.

Table 49 — Generic parameters for irrigation Operations

Formula (RecipeType)				
Initial condition	**Running parameters**	**Final condition**	**Type**	**Description**
Required parameters				
StartDate			string	Date/time consigned for the start of the Operation. In coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm. No default value, its inclusion is required.
		StopRecipe	boolean	StopRecipe action is sent to the subsystem. Default value 0.
		NewRecipe	queue	Another queuing Operation reaches its start condition (StartDate).
Optional parameters				
	OpeningDegree		integer	Opening degree of the entity, expressed as a percentage. Dead zone ±5. Default value 100.
Optional conditioning parameters				
	MonCumulativeVolumeOut		boolean	Activate/deactivate the monitoring of the output volume. Default value 0.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Formula (RecipeType)				
Initial condition	**Running parameters**	**Final condition**	**Type**	**Description**
	MonInternalFlowOut		boolean	Activate/deactivate the monitoring of the output flow. Default value 0.
	MonPressureOut		boolean	Activate/deactivate the monitoring of the output pressure. Default value 0.
Required parameters conditioned by activation of the monitoring of a cumulative property: CumulativeVolumeOut				
	ThresholdHH		decimal	Very high threshold value of the property for which monitoring is activated. When the ThresholdHH is exceeded, during the configured time, an event is generated.
Optional parameters conditioned by activation of the monitoring of a cumulative property: CumulativeVolumeOut				
	CmdHH		boolean	Its activation forces the Operation to stop its execution when ThresholdHH is reached. Parameter conditioned by ThresholdHH.Default value 0.
Required parameters conditioned by activation of the monitoring of a property: InternalFlowOut, PressureOut				
	ThresholdHH		decimal	Very high threshold value of the property for which monitoring is activated. When the ThresholdHH is exceeded, during the configured time, an event is generated. Required if ThresholdLL=0.
	ThresholdLL		decimal	Very low threshold value of the property for which monitoring is activated. When the ThresholdLL is exceeded, during the configured time, an event is generated. Required if ThresholdHH=0.
Optional parameters conditioned by activation of the monitoring of a property: InternalFlowOut, PressureOut				
	TimeHH		integer	Time in seconds where the threshold HH shall be exceeded. Parameter conditioned by ThresholdHH. Default value 30 seconds.
	CmdHH		boolean	Its activation forces the Operation to stop when ThresholdHH is reached during the configured time. Parameter conditioned by ThresholdHH. Default value 0.
	TimeLL		integer	Time in seconds where the threshold LL shall be exceeded. Parameter conditioned by ThresholdLL. Default value 30 s.
	CmdLL		boolean	Its activation forces the Operation to stop when ThresholdLL is reached during the configured time. Parameter conditioned by ThresholdLL. Default value 0.

6.3.4 Additional parameters of an IrrigationRecipe1

The following specific parameters shall be added to the generic parameters to design an Operation recipe of type IrrigationRecipe1. When the recipe is running, the Mode property of the irrigation entity changes to Programmed.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

Table 50 — Specific parameters of IrrigationRecipe1

Formula (RecipeType)				
Initial condition	**Running parameters**	**Final condition**	**Type**	**Description**
Required parameters				
		MaxDuration	integer	Maximum time of duration of the Operation, since the start condition has been reached. Expressed in seconds. No default value.
Required parameters for SSS and IHG				
	TimeSequence		string	String composed of one or more groups of two fields separated by commas. Each group corresponds to the parameterization of a SSB or a VIH. The string can contain as many groups as this kind of entities has the entity. Each group has: Value1: EntityID of the SSB or VIH where the value 2 is going to be executed. Value2: quantity of time to irrigate, expressed in seconds.
Optional parameters				
		MaxVolume	decimal	Maximum volume during the Operation. With a decimal point and expressed in m^3. No default value.
Optional parameters for SSS and IHG				
	VolumeSequence		string	String composed of one or more groups of two fields separated by commas. Each group corresponds to the parameterization of a SSb or a VIH. The string can contain as many groups as this kind of entities has the entity. Each group has: Value1: EntityID of the SSB or VIH where the value 2 is going to be executed. Value2: quantity of water to irrigate, expressed in m^3.
Optional conditioning parameters				
Repetition			boolean	Activate the Operation repetition. Default value 0 (deactivate).
Required parameters conditioned by activation of Repetition				
	RepetitionInterval		integer	Time interval between repetitions, expressed in seconds and added to the StartDate parameter of the last execution.
	RepetitionNumber		integer	Number of times that the RepetitionInterval parameter shall be repeated. Without limitation.

If the repetition of the operation is set up, any of the resulting repetitions shall be considered an instance of it. The subsystem in charge shall assign an internal identification for each instance of the operation.

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024

6.3.5 Additional parameters of a IrrigationRecipe3

The following specific parameters shall be added to the generic parameters to design an Operation recipe of type IrrigationRecipe3. When the recipe is running, the Mode property of the irrigation entity shall be changed to Programmed.

Table 51 — Specific parameters of IrrigationRecipe3

Formula (RecipeType)				
Initial condition	**Running parameters**	**Final condition**	**Type**	**Description**
Required parameters				
		MaxDuration	integer	Maximum time of duration of the Operation, since the start condition has been reached. Expressed in seconds. No default value.
	WeekCalendar		string	Contains 7 fields separated by commas, representing a week (first field is for Monday and the last for Sunday according to ISO 8601). Each field can take one of the next values: — Value=1, when the irrigation recipe should be executed in that day. — Value=0, irrigation recipe should not be executed in that day. Without default values.
		FinalDate	string	Date/time consigned for the end of the Operation. In coordinated universal time (UTC) ISO 8601 format YYYYMMDDhhmmss±hhmm. No default value, its inclusion is required.
Optional parameters				
		MaxVolume	integer	Maximum volume during the Operation. With a decimal point and expressed in m^3. No default value.

Any of the resulting repetitions result of the operation setup shall be considered an instance of it. The subsystem in charge assigns an internal identification for each instance of the operation.

6.3.6 Additional parameters of a IrrigationRecipe4

The design of an Operation type IrrigationRecipe4 requires specific parameters in addition to the abovementioned generic parameters. An IrrigationRecipe4 shall contain, at least, one of the optional parameters listed in Table 52. When the recipe is running, the Mode property of the irrigation entity shall be changed to Programmed.

Table 52 — Specific parameters of IrrigationRecipe4

Formula (RecipeType)				
Initial condition	**Running parameters**	**Final condition**	**Type**	**Description**
Required parameters				

© ISO 2024 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 21622-3:2024