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Industrial automation systems and integration — Product data representation and exchange —

Part 212: Application protocol: Electrotechnical design and installation

*Systèmes d'automatisation industrielle et intégration — Représentation et
échange de données de produits —*

*Partie 212: Protocole d'application: Conception électrotechnique et
installation*

Reference number
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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
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Contents	Page
1 Scope.....	1
2 Normative references	3
3 Terms, definitions, and abbreviations.....	5
3.1 Terms defined in IEC 61082-1	5
3.2 Terms defined in ISO 10303-1	5
3.3 Terms defined in ISO 10303-31	6
3.4 Terms defined in ISO 10303-42	6
3.5 Terms defined in ISO 10303-44	6
3.6 Terms defined in ISO 10303-46	6
3.7 Other terms and definitions.....	6
3.8 Abbreviations	10
4 Information requirements.....	11
4.1 Units of functionality	11
4.1.1 allocation (AL1).....	12
4.1.2 classification (CA1).....	12
4.1.3 conditions (CD1)	13
4.1.4 configuration_management (CF1).....	13
4.1.5 course (CO1).....	14
4.1.6 designation (DE1).....	15
4.1.7 dimensioned_documentation (DI1)	15
4.1.8 documentation (DO1)	16
4.1.9 effectivity_data (EF1).....	19
4.1.10 external_reference (ER1).....	19
4.1.11 function_structure (F1).....	21
4.1.12 functional_connectivity (FC1).....	21

ISO 10303-212:2001(E)

4.1.13	installation (IN1).....	22
4.1.14	messages (M1).....	24
4.1.15	network_allocation (NA1).....	24
4.1.16	organizational_data (OD1).....	25
4.1.17	physical_connectivity (PC1).....	25
4.1.18	product_structure (PD1).....	27
4.1.19	properties (PR1).....	28
4.1.20	remark (R1).....	30
4.1.21	schematic_documentation (SC1).....	30
4.1.22	site (SI1).....	31
4.1.23	work_management (W1).....	31
4.2	Application objects.....	32
4.3	Application assertions.....	403
5	Application interpreted model.....	664
5.1	Mapping table.....	664
5.2	AIM EXPRESS short listing.....	1644
6	Conformance requirements.....	2012
6.1	Conformance class for Design_physical_characterization (CC 1).....	2013
6.2	Conformance class for Design_characterization (CC 2).....	2013
6.3	Conformance class for Spatial_arrangement (CC 3).....	2013
6.4	Conformance class for Design_characterization_and_spatial_arrangement (CC 4).....	2013
6.5	Conformance class for Spatial_arrangement_and_configuration_data (CC 5).....	2013
6.6	Conformance class for Documented_design_characterization (CC 6).....	2014
6.7	Conformance class for Documented_item_characterization (CC 7).....	2014
6.8	Conformance class for Complete_system_characterization (CC 8).....	2014
6.9	Conformance class for Product_structure_and_work_management_data (CC 9).....	2014
6.10	Conformance class for Design_structure_and_work_mnagement_data (CC 10).....	2014
6.11	Conformance class for Location_information_and_work_management_data (CC 11).....	2014
6.12	Conformance class for Design_structure_and_configuration_data (CC 12).....	2014
6.13	Conformance class for Item_structure_and_configuration_data (CC 13).....	2014
6.14	Conformance class for Documented_design_structure_and_configuration_data (CC 14).....	2014
6.15	Conformance class for Documented_item_structure_and_configuration_data (CC 15).....	2015
Annex A	(normative) AIM EXPRESS expanded listing.....	2097
Annex B	(normative) AIM short names.....	2385

Annex C (normative) Implementation method specific requirements	2412
Annex D (normative) Protocol Implementation Conformance Statement (PICS) proforma	2413
Annex E (normative) Information object registration	2416
E.1 Document identification	2416
E.2 Schema identification	2416
Annex F (informative) Application activity model	2417
F.1 Application activity model definitions and abbreviations	2417
F.2 Application activity model diagrams	2426
Annex G (informative) Application reference model	2439
Annex H (informative) AIM EXPRESS-G	2533
Annex J (informative) Computer interpretable listings	2630
 Bibliography	 2631
 Index	 2632

Figures

Figure 1 - Electrical equipment in a tramcar	xiv
Figure 2 - Product data that characterizes industrial electrotechnical equipment	xvi
Figure 3 - Data planning model	xviii
Figure 4 - Functionality of a gas - insulated switchgear	22
Figure 5 - Example of an installation; installation of devices on cabletrays or in cabinets	23
Figure 6 - Example of a product description; outcut of a wiring harness	26
Figure 7 - Hierarchical composition	64
Figure 8 - Configuration inheritance scheme	91
Figure 9 - Connection_bundle of Connection objects	94
Figure 10 - Predefined corner styles	102
Figure 11 - Predefined curve end styles	103
Figure 12 - Predefined dimension symbols	133
Figure 13 - Power transformer fed through an overhead cable	186
Figure 14 - Predefined geometrical tolerance symbols	205
Figure 15 - Internally wired connector	219
Figure 16 - Predefined point marker symbols	280

ISO 10303-212:2001(E)

Figure 17 - Predefined section end shapes.....	333
Figure 18 - Predefined terminator symbols.....	375
Figure 19 - Text characteristics.....	379
Figure 20 - Mirror angle.....	381
Figure 21 - Text appearance and rotation of text.....	383
Figure F.1 - AAM diagram of node A-0: Electrotechnical design and installation.....	2426
Figure F.2 - AAM diagram of node A0: Engineer electrotechnical system	2427
Figure F.3 - AAM diagram of node A1: Identify system.....	2428
Figure F.4 - AAM diagram of node A2: Develop conceptual design.....	2430
Figure F.5 - AAM diagram of node A3: Develop system.....	2431
Figure F.6 - AAM diagram of node A4: Implement system	2432
Figure F.7 - AAM diagram of node A5: Put system into operation	2433
Figure G.1 - ARM diagram in EXPRESS-G: 1 of 93	2440
Figure G.2 - ARM diagram in EXPRESS-G: 2 of 93	2441
Figure G.3 - ARM diagram in EXPRESS-G: 3 of 93	2442
Figure G.4 - ARM diagram in EXPRESS-G: 4 of 93	2443
Figure G.5 - ARM diagram in EXPRESS-G: 5 of 93	2444
Figure G.6 - ARM diagram in EXPRESS-G: 6 of 93	2445
Figure G.7 - ARM diagram in EXPRESS-G: 7 of 93	2446
Figure G.8 - ARM diagram in EXPRESS-G: 8 of 93	2447
Figure G.9 - ARM diagram in EXPRESS-G: 9 of 93	2448
Figure G.10 - ARM diagram in EXPRESS-G: 10 of 93	2449
Figure G.11 - ARM diagram in EXPRESS-G: 11 of 93	2450
Figure G.12 - ARM diagram in EXPRESS-G: 12 of 93	2451
Figure G.13 - ARM diagram in EXPRESS-G: 13 of 93	2452
Figure G.14 - ARM diagram in EXPRESS-G: 14 of 93	2453
Figure G.15 - ARM diagram in EXPRESS-G: 15 of 93	2454
Figure G.16 - ARM diagram in EXPRESS-G: 16 of 93	2455
Figure G.17 - ARM diagram in EXPRESS-G: 17 of 93	2456
Figure G.18 - ARM diagram in EXPRESS-G: 18 of 93	2457
Figure G.19 - ARM diagram in EXPRESS-G: 19 of 93	2458
Figure G.20 - ARM diagram in EXPRESS-G: 20 of 93	2459
Figure G.21 - ARM diagram in EXPRESS-G: 21 of 93	2460
Figure G.22 - ARM diagram in EXPRESS-G: 22 of 93	2461
Figure G.23 - ARM diagram in EXPRESS-G: 23 of 93	2462

Figure G.24 - ARM diagram in EXPRESS-G: 24 of 93	2463
Figure G.25 - ARM diagram in EXPRESS-G: 25 of 93	2464
Figure G.26 - ARM diagram in EXPRESS-G: 26 of 93	2465
Figure G.27 - ARM diagram in EXPRESS-G: 27 of 93	2466
Figure G.28 - ARM diagram in EXPRESS-G: 28 of 93	2467
Figure G.29 - ARM diagram in EXPRESS-G: 29 of 93	2468
Figure G.30 - ARM diagram in EXPRESS-G: 30 of 93	2469
Figure G.31 - ARM diagram in EXPRESS-G: 31 of 93	2470
Figure G.32 - ARM diagram in EXPRESS-G: 32 of 93	2471
Figure G.33 - ARM diagram in EXPRESS-G: 33 of 93	2472
Figure G.34 - ARM diagram in EXPRESS-G: 34 of 93	2473
Figure G.35 - ARM diagram in EXPRESS-G: 35 of 93	2474
Figure G.36 - ARM diagram in EXPRESS-G: 36 of 93	2475
Figure G.37 - ARM diagram in EXPRESS-G: 37 of 93	2476
Figure G.38 - ARM diagram in EXPRESS-G: 38 of 93	2477
Figure G.39 - ARM diagram in EXPRESS-G: 39 of 93	2478
Figure G.40 - ARM diagram in EXPRESS-G: 40 of 93	2479
Figure G.41 - ARM diagram in EXPRESS-G: 41 of 93	2480
Figure G.42 - ARM diagram in EXPRESS-G: 42 of 93	2481
Figure G.43 - ARM diagram in EXPRESS-G: 43 of 93	2482
Figure G.44 - ARM diagram in EXPRESS-G: 44 of 93	2483
Figure G.45 - ARM diagram in EXPRESS-G: 45 of 93	2484
Figure G.46 - ARM diagram in EXPRESS-G: 46 of 93	2485
Figure G.47 - ARM diagram in EXPRESS-G: 47 of 93	2486
Figure G.48 - ARM diagram in EXPRESS-G: 48 of 93	2487
Figure G.49 - ARM diagram in EXPRESS-G: 49 of 93	2488
Figure G.50 - ARM diagram in EXPRESS-G: 50 of 93	2489
Figure G.51 - ARM diagram in EXPRESS-G: 51 of 93	2490
Figure G.52 - ARM diagram in EXPRESS-G: 52 of 93	2491
Figure G.53 - ARM diagram in EXPRESS-G: 53 of 93	2492
Figure G.54 - ARM diagram in EXPRESS-G: 54 of 93	2493
Figure G.55 - ARM diagram in EXPRESS-G: 55 of 93	2494
Figure G.56 - ARM diagram in EXPRESS-G: 56 of 93	2495
Figure G.57 - ARM diagram in EXPRESS-G: 57 of 93	2496
Figure G.58 - ARM diagram in EXPRESS-G: 58 of 93	2497

ISO 10303-212:2001(E)

Figure G.59 - ARM diagram in EXPRESS-G: 59 of 93	2498
Figure G.60 - ARM diagram in EXPRESS-G: 60 of 93	2499
Figure G.61 - ARM diagram in EXPRESS-G: 61 of 93	2500
Figure G.62 - ARM diagram in EXPRESS-G: 62 of 93	2501
Figure G.63 - ARM diagram in EXPRESS-G: 63 of 93	2502
Figure G.64 - ARM diagram in EXPRESS-G: 64 of 93	2503
Figure G.65 - ARM diagram in EXPRESS-G: 65 of 93	2504
Figure G.66 - ARM diagram in EXPRESS-G: 66 of 93	2505
Figure G.67 - ARM diagram in EXPRESS-G: 67 of 93	2506
Figure G.68 - ARM diagram in EXPRESS-G: 68 of 93	2507
Figure G.69 - ARM diagram in EXPRESS-G: 69 of 93	2508
Figure G.70 - ARM diagram in EXPRESS-G: 70 of 93	2509
Figure G.71 - ARM diagram in EXPRESS-G: 71 of 93	2510
Figure G.72 - ARM diagram in EXPRESS-G: 72 of 93	2511
Figure G.73 - ARM diagram in EXPRESS-G: 73 of 93	2512
Figure G.74 - ARM diagram in EXPRESS-G: 74 of 93	2513
Figure G.75 - ARM diagram in EXPRESS-G: 75 of 93	2514
Figure G.76 - ARM diagram in EXPRESS-G: 76 of 93	2515
Figure G.77 - ARM diagram in EXPRESS-G: 77 of 93	2516
Figure G.78 - ARM diagram in EXPRESS-G: 78 of 93	2517
Figure G.79 - ARM diagram in EXPRESS-G: 79 of 93	2518
Figure G.80 - ARM diagram in EXPRESS-G: 80 of 93	2519
Figure G.81 - ARM diagram in EXPRESS-G: 81 of 93	2520
Figure G.82 - ARM diagram in EXPRESS-G: 82 of 93	2521
Figure G.83 - ARM diagram in EXPRESS-G: 83 of 93	2522
Figure G.84 - ARM diagram in EXPRESS-G: 84 of 93	2523
Figure G.85 - ARM diagram in EXPRESS-G: 85 of 93	2524
Figure G.86 - ARM diagram in EXPRESS-G: 86 of 93	2525
Figure G.87 - ARM diagram in EXPRESS-G: 87 of 93	2526
Figure G.88 - ARM diagram in EXPRESS-G: 88 of 93	2527
Figure G.89 - ARM diagram in EXPRESS-G: 89 of 93	2528
Figure G.90 - ARM diagram in EXPRESS-G: 90 of 93	2529
Figure G.91 - ARM diagram in EXPRESS-G: 91 of 93	2530
Figure G.92 - ARM diagram in EXPRESS-G: 92 of 93	2531
Figure G.93 - ARM diagram in EXPRESS-G: 93 of 93	2532

Figure H.1 - AIM diagram in EXPRESS-G: 1 of 96.....	2534
Figure H.2 - AIM diagram in EXPRESS-G: 2 of 96.....	2535
Figure H.3 - AIM diagram in EXPRESS-G: 3 of 96.....	2536
Figure H.4 - AIM diagram in EXPRESS-G: 4 of 96.....	2537
Figure H.5 - AIM diagram in EXPRESS-G: 5 of 96.....	2538
Figure H.6 - AIM diagram in EXPRESS-G: 6 of 96.....	2539
Figure H.7 - AIM diagram in EXPRESS-G: 7 of 96.....	2540
Figure H.8 - AIM diagram in EXPRESS-G: 8 of 96.....	2541
Figure H.9 - AIM diagram in EXPRESS-G: 9 of 96.....	2542
Figure H.10 - AIM diagram in EXPRESS-G: 10 of 96.....	2543
Figure H.11 - AIM diagram in EXPRESS-G: 11 of 96.....	2544
Figure H.12 - AIM diagram in EXPRESS-G: 12 of 96.....	2545
Figure H.13 - AIM diagram in EXPRESS-G: 13 of 96.....	2546
Figure H.14 - AIM diagram in EXPRESS-G: 14 of 96.....	2547
Figure H.15 - AIM diagram in EXPRESS-G: 15 of 96.....	2548
Figure H.16 - AIM diagram in EXPRESS-G: 16 of 96.....	2549
Figure H.17 - AIM diagram in EXPRESS-G: 17 of 96.....	2550
Figure H.18 - AIM diagram in EXPRESS-G: 18 of 96.....	2551
Figure H.19 - AIM diagram in EXPRESS-G: 19 of 96.....	2552
Figure H.20 - AIM diagram in EXPRESS-G: 20 of 96.....	2553
Figure H.21 - AIM diagram in EXPRESS-G: 21 of 96.....	2554
Figure H.22 - AIM diagram in EXPRESS-G: 22 of 96.....	2555
Figure H.23 - AIM diagram in EXPRESS-G: 23 of 96.....	2556
Figure H.24 - AIM diagram in EXPRESS-G: 24 of 96.....	2557
Figure H.25 - AIM diagram in EXPRESS-G: 25 of 96.....	2558
Figure H.26 - AIM diagram in EXPRESS-G: 26 of 96.....	2559
Figure H.27 - AIM diagram in EXPRESS-G: 27 of 96.....	2560
Figure H.28 - AIM diagram in EXPRESS-G: 28 of 96.....	2561
Figure H.29 - AIM diagram in EXPRESS-G: 29 of 96.....	2562
Figure H.30 - AIM diagram in EXPRESS-G: 30 of 96.....	2563
Figure H.31 - AIM diagram in EXPRESS-G: 31 of 96.....	2564
Figure H.32 - AIM diagram in EXPRESS-G: 32 of 96.....	2565
Figure H.33 - AIM diagram in EXPRESS-G: 33 of 96.....	2566
Figure H.34 - AIM diagram in EXPRESS-G: 34 of 96.....	2567
Figure H.35 - AIM diagram in EXPRESS-G: 35 of 96.....	2568

ISO 10303-212:2001(E)

Figure H.36 - AIM diagram in EXPRESS-G: 36 of 96.....	2569
Figure H.37 - AIM diagram in EXPRESS-G: 37 of 96.....	2570
Figure H.38 - AIM diagram in EXPRESS-G: 38 of 96.....	2571
Figure H.39 - AIM diagram in EXPRESS-G: 39 of 96.....	2572
Figure H.40 - AIM diagram in EXPRESS-G: 40 of 96.....	2573
Figure H.41 - AIM diagram in EXPRESS-G: 41 of 96.....	2574
Figure H.42 - AIM diagram in EXPRESS-G: 42 of 96.....	2575
Figure H.43 - AIM diagram in EXPRESS-G: 43 of 96.....	2576
Figure H.44 - AIM diagram in EXPRESS-G: 44 of 96.....	2577
Figure H.45 - AIM diagram in EXPRESS-G: 45 of 96.....	2578
Figure H.46 - AIM diagram in EXPRESS-G: 46 of 96.....	2579
Figure H.47 - AIM diagram in EXPRESS-G: 47 of 96.....	2580
Figure H.48 - AIM diagram in EXPRESS-G: 48 of 96.....	2581
Figure H.49 - AIM diagram in EXPRESS-G: 49 of 96.....	2582
Figure H.50 - AIM diagram in EXPRESS-G: 50 of 96.....	2583
Figure H.51 - AIM diagram in EXPRESS-G: 51 of 96.....	2584
Figure H.52 - AIM diagram in EXPRESS-G: 52 of 96.....	2585
Figure H.53 - AIM diagram in EXPRESS-G: 53 of 96.....	2586
Figure H.54 - AIM diagram in EXPRESS-G: 54 of 96.....	2587
Figure H.55 - AIM diagram in EXPRESS-G: 55 of 96.....	2588
Figure H.56 - AIM diagram in EXPRESS-G: 56 of 96.....	2589
Figure H.57 - AIM diagram in EXPRESS-G: 57 of 96.....	2590
Figure H.58 - AIM diagram in EXPRESS-G: 58 of 96.....	2591
Figure H.59 - AIM diagram in EXPRESS-G: 59 of 96.....	2592
Figure H.60 - AIM diagram in EXPRESS-G: 60 of 96.....	2593
Figure H.61 - AIM diagram in EXPRESS-G: 61 of 96.....	2594
Figure H.62 - AIM diagram in EXPRESS-G: 62 of 96.....	2595
Figure H.63 - AIM diagram in EXPRESS-G: 63 of 96.....	2596
Figure H.64 - AIM diagram in EXPRESS-G: 64 of 96.....	2597
Figure H.65 - AIM diagram in EXPRESS-G: 65 of 96.....	2598
Figure H.66 - AIM diagram in EXPRESS-G: 66 of 96.....	2599
Figure H.67 - AIM diagram in EXPRESS-G: 67 of 96.....	2600
Figure H.68 - AIM diagram in EXPRESS-G: 68 of 96.....	2601
Figure H.69 - AIM diagram in EXPRESS-G: 69 of 96.....	2602
Figure H.70 - AIM diagram in EXPRESS-G: 70 of 96.....	2603

Figure H.71 - AIM diagram in EXPRESS-G: 71 of 96.....	2604
Figure H.72 - AIM diagram in EXPRESS-G: 72 of 96.....	2605
Figure H.73 - AIM diagram in EXPRESS-G: 73 of 96.....	2606
Figure H.74 - AIM diagram in EXPRESS-G: 74 of 96.....	2607
Figure H.75 - AIM diagram in EXPRESS-G: 75 of 96.....	2608
Figure H.76 - AIM diagram in EXPRESS-G: 76 of 96.....	2609
Figure H.77 - AIM diagram in EXPRESS-G: 77 of 96.....	2610
Figure H.78 - AIM diagram in EXPRESS-G: 78 of 96.....	2611
Figure H.79 - AIM diagram in EXPRESS-G: 79 of 96.....	2612
Figure H.80 - AIM diagram in EXPRESS-G: 80 of 96.....	2613
Figure H.81 - AIM diagram in EXPRESS-G: 81 of 96.....	2614
Figure H.82 - AIM diagram in EXPRESS-G: 82 of 96.....	2615
Figure H.83 - AIM diagram in EXPRESS-G: 83 of 96.....	2616
Figure H.84 - AIM diagram in EXPRESS-G: 84 of 96.....	2617
Figure H.85 - AIM diagram in EXPRESS-G: 85 of 96.....	2618
Figure H.86 - AIM diagram in EXPRESS-G: 86 of 96.....	2619
Figure H.87 - AIM diagram in EXPRESS-G: 87 of 96.....	2620
Figure H.88 - AIM diagram in EXPRESS-G: 88 of 96.....	2621
Figure H.89 - AIM diagram in EXPRESS-G: 89 of 96.....	2622
Figure H.90 - AIM diagram in EXPRESS-G: 90 of 96.....	2623
Figure H.91 - AIM diagram in EXPRESS-G: 91 of 96.....	2624
Figure H.92 - AIM diagram in EXPRESS-G: 92 of 96.....	2625
Figure H.93 - AIM diagram in EXPRESS-G: 93 of 96.....	2626
Figure H.94 - AIM diagram in EXPRESS-G: 94 of 96.....	2627
Figure H.95 - AIM diagram in EXPRESS-G: 95 of 96.....	2628
Figure H.96 - AIM diagram in EXPRESS-G: 96 of 96.....	2629

Tables

Table 1 - RGB values for predefined colors	286
Table 2 - Line segment and space lengths for predefined curve font lists.....	287
Table 3 - AIC references for mapping tables.....	665
Table 4 - Mapping table allocation UoF	666
Table 5 - Mapping table classification UoF.....	672
Table 6 - Mapping table conditions UoF	686
Table 7 - Mapping table configuration_management UoF	705
Table 8 - Mapping table course UoF	746
Table 9 - Mapping table designation UoF	756
Table 10 - Mapping table dimensioned_documentation UoF.....	758
Table 11 - Mapping table documentation UoF	777
Table 12 - Mapping table effectivity_data UoF.....	850
Table 13 - Mapping table external_reference UoF	965
Table 14 - Mapping table function_structure UoF	1008
Table 15 - Mapping table functional_connectivity UoF.....	1020
Table 16 - Mapping table installation UoF	1027
Table 17 - Mapping table messages UoF.....	1053
Table 18 - Mapping table network_allocation UoF.....	1074
Table 19 - Mapping table organizational_data UoF	1079
Table 20 - Mapping table organizational_data UoF	1263
Table 21 - Mapping table physical_connectivity UoF.....	1285
Table 22 - Mapping table product_structure UoF.....	1295
Table 23 - Mapping table properties UoF.....	1359
Table 24 - Mapping table remark UoF.....	1443
Table 25 - Mapping table schematic_documentation UoF	1509
Table 26 - Mapping table site UoF	1546
Table 27 - Mapping table work_management UoF	1564
Table 29 - Usage of AIM elements in conformance classes.....	2019
Table B.1 - AIM short names of entities.....	2385
Table F.1 - AAM - data classes.....	2435

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 10303 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10303-212 was prepared jointly by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*, and IEC/TC 3, *Information structures, documentation and graphical symbols*. The draft was circulated for voting to the national bodies of both ISO and IEC.

The technical committees involved have agreed not to change any part of this part of ISO 10303 without mutual agreement.

This International Standard is organized as a series of parts, each published separately. The structure of this International Standard is described in ISO 10303-1.

Each part of this International Standard is a member of one of the following series: description methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated application resources, application protocols, abstract test suites, application interpreted constructs, and application modules. This part is a member of the application protocol series.

A complete list of parts of ISO 10303 is available from the Internet:

[<http://www.nist.gov/sc4/editing/step/titles/>](http://www.nist.gov/sc4/editing/step/titles/)

Annexes A to E form a normative part of this part of ISO 10303. Annexes F to J are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the application protocol series.

EXAMPLE 1 The Figure 1 shows electrotechnical equipment in a tramcar.

EXAMPLE 2 In large installations, cables are often customized during the commissioning of an electrotechnical system.

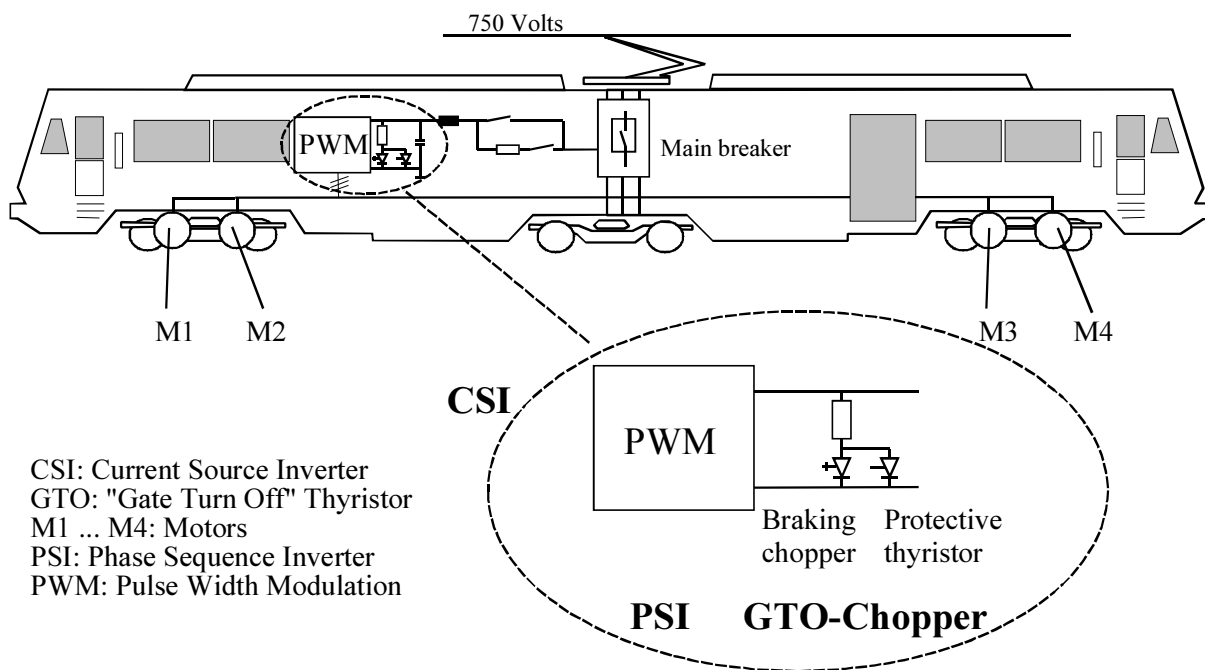


Figure 1 - Electrical equipment in a tramcar

This part of ISO 10303 specifies an application protocol (AP) for design and installation information of electrotechnical equipment used in plants, industrial systems or vehicles. This part describes the information shared between the parties involved in the design, the installation and the commissioning of the apparatus. Design is understood as a process of combining components such as relays, programmable logic controllers, or software that comprise a system. Such a system may also be used to control a chemical process in a factory. The description includes various characteristics of the

design, such as functional aspects, physical aspects or the aspects related to the installation of the equipment.

The detailed product information of procured or premanufactured parts is not included in the AP but the information needed to customize products accordingly to the requirements of the installation is included.

EXAMPLE 3 Figure 2 shows some product data that characterize an electrotechnical system. The circuitry essentially comprises the product data for main circuits and the control circuits together with the circuits for control, indication and monitoring. In Figure 2 the functions describe functional building blocks that specify the logical structure of the system, their connectivity and the signals used. The arrangement data describe how the components that make up the system are physically arranged.

Figure 3 contains the data planning model that provides a high level description of the requirements for this application protocol, as well as the relationships between the basic data components.

The planning model illustrates that an electrotechnical system is described by function-oriented product data and product-oriented product data. Both descriptions may be allocated to each other. Arrangement data, the routing of cables and the arrangement of the equipment is described by the UoFs installation, course, and site. In many cases the system components are categorized in accordance to an existing classification system. The UoF classification specifies the necessary concepts.

The information flow within the system may be described by specifying the signals that are generated, processed or transmitted within the system. The UoF messages comprises the concepts that specify the information flow.

The UoF remark allows to assign explanatory information to the system or its constituents. Organizational data such as approval or manufacturer is described by the UoF organizational_data.

Requirements and constraints levied against the system are represented by conditions that affect the products used, their functionality and their installation. Configuration_management, organizational_data, and work_management allow the handling of data concerning information about variants and options of the design, releases and approvals, or the appointment of work.

The documentation of the system is addressed by the documentation and dimensioned_documentation data. Designation data allows the identification of the equipment or its functions uniquely within the system. Technical data may be addressed by assigning property data to the elements of the data model.

This application protocol defines the context, scope, and information requirements for the exchange of design and installation information of electrotechnical equipment and specifies the integrated resources necessary to satisfy these requirements.

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarizes the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers to words defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in annex F. The information requirements of the application are specified in clause



Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in Annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex C.

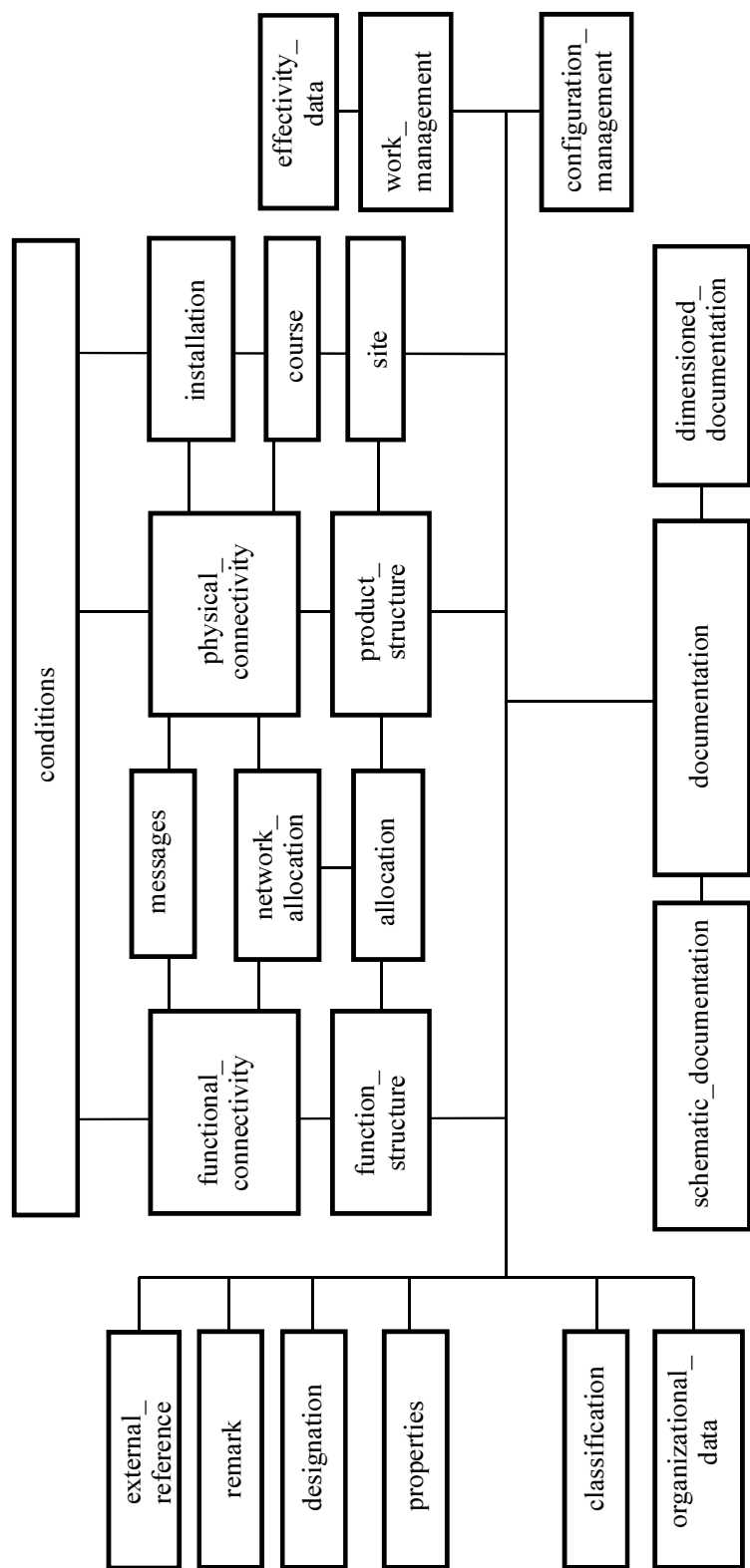


Figure 3 - Data planning model

Industrial automation systems and integration — Product data representation and exchange — Part 212: Application protocol: Electrotechnical design and installation

1 Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the design, installation, and commissioning of electrotechnical systems. This Application protocol does not impose any restriction on the usage of these systems. Equipment for power-transmission, -distribution, and -generation, electrical machinery, electric light, electric heat, control and automation systems is in scope.

EXAMPLE 1 Electrotechnical systems may be used in plants, buildings, or transportation systems such as cars or ships, etc.

The information content of documents that describe a system in accordance to IEC 61082: *Preparation of documents used in electrotechnology* is part of the scope. Also included is the decomposition of products and functions, their interrelations, their connectivity and their schematic representation.

NOTE 1 The application activity model in annex F provides a graphical representation of the processes and information flows that are the basis for the definition of the scope of this part of ISO 10303.

The following are within the scope of this part of ISO 10303.

— Data to describe an electrotechnical system throughout design, commissioning and delivery phases;

NOTE 2 Throughout the commissioning of a system an operating time of significant duration may occur. Such a stage is often requested by the customer to verify the operating performance of the system. The data required to keep track of design changes or maintenance activities are considered to be part of the data that describe commissioning of the system.

— Data to specify the equipment used in the electrotechnical system;

— Data to describe terminals and interfaces of the equipment;

— Data to describe the functional decomposition of the system;

— Data to describe the connectivity and cabling of devices and equipment;

ISO 10303-212:2001(E)

- Data to specify the installation of the equipment, including physical locations and information about the shape of the equipment;
- Data for the reference designation of the design's functional modules and of the equipment used;
- Data to specify the pieces of information exchanged between the various constituents of the design;
- Data to provide the design with actual and planned technical characteristics;
- Data to document the system or its design and to keep track of version and status of the documentation;
- Data for the tracking of a design's release;
- Data to track the approval of functional and physical objects used in the system;
- Data to perform the configuration management of the equipment;
- Data to describe the requirements levied upon the design and their allocation to functional objects, physical objects, and the physical implementation;
- Data to provide information about the contractual basis and the work packages assigned to develop and implement the design;
- Data to classify and categorize the functional and physical objects that make up the electrotechnical system in accordance to standardized or user specific classification systems;
- Data to the assignment of comments or instructions to the product data;

The following are outside the scope of this part of ISO 10303.

- Detailed product information or manufacturing information of procured premanufactured parts;
- Data for the simulation and testing of electrotechnical systems;

EXAMPLE 2 Information about test patterns, behavioural models, etc.

- Detailed mechanical design information of electric/electronic products;
- The management of the process used for the design of electrotechnical systems;
- The process plans for the procurement, assembly or shipping of electrotechnical systems or their constituents;
- The administrative procurement and cost data used by an enterprise.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

IEC 61082-1:1991, *Preparation of documents used in electrotechnology — Part 1: General requirements*.

IEC 61360:1995, *Standard data element types with associated classification scheme for electric components*.

ISO 639:1988, *Code for the representation of names of languages*.

ISO/IEC 646:1991, *Information technology — ISO 7-bit coded character set for information interchange*.

ISO/IEC 6937:1994, *Information technology — Coded character set for text communication — Latin alphabet*.

ISO/IEC 8824-1:1998, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*.

ISO/IEC 8859-1:1998, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*.

ISO/IEC 10646, *Information technology — Universal Multiple-Octet Coded Character Set (UCS)*.

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*.

ISO 10303-21:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*.

ISO 10303-31:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 31: Conformance testing methodology and framework: General concepts*.

ISO 10303-212:2001(E)

ISO 10303-32:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 32: Conformance testing methodology and framework: Requirements on testing laboratories and clients.*

ISO 10303-41:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resource: Fundamentals of product description and support.*

ISO 10303-42:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resources: Geometric and topological representation.*

ISO 10303-43:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resource: Representation structures.*

ISO 10303-44:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resource: Product structure configuration.*

ISO 10303-45:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resource: Materials.*

ISO 10303-46:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation.*

ISO 10303-49:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 49: Integrated generic resources: Process structure and properties.*

ISO 10303-504:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 504: Application interpreted construct: Draughting annotation.*

ISO 10303-506:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 506: Application interpreted construct: Draughting elements.*

3 Terms, definitions, and abbreviations

For the purposes of this International Standard, the following definitions apply.

3.1 Terms defined in IEC 61082-1

For the purposes of this part of ISO 10303, the following terms defined in IEC 61082-1 apply.

- attached representation;
- block diagram;
- circuit diagram;
- connection diagram;
- detached representation;
- diagram;
- document;
- function diagram;
- overview diagram.

3.2 Terms defined in ISO 10303-1

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-1 apply.

- application;
- application activity model (AAM);
- application interpreted model (AIM);
- application object;
- application protocol (AP);
- application reference model (ARM);
- conformance testing;
- implementation method;
- integrated resource;
- model;
- PICS proforma;
- product;

ISO 10303-212:2001(E)

- product data;
- unit of functionality (UoF).

3.3 Terms defined in ISO 10303-31

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-31 apply.

- conformance class.

3.4 Terms defined in ISO 10303-42

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-42 apply.

- b spline curve;
- composite curve;
- conic;
- coordinate space;
- curve;
- line;
- polyline;
- trimmed curve.

3.5 Terms defined in ISO 10303-44

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-44 apply.

- constituent.

3.6 Terms defined in ISO 10303-46

For the purposes of this part of ISO 10303, the following terms defined in ISO 10303-46 apply.

- layer;
- presentation;
- visualization.

3.7 Other terms and definitions

For the purposes of this part of ISO 10303, the following terms and definitions apply.

3.7.1

circuit

an arrangement of networks, devices, or media that allows the flow or association of information, energy, or material within a physical or non-physical product

3.7.2

coded character set

a set of unambiguous rules that establishes a character set and the one-to-one relationship between each character of the set and its coded representation

3.7.3

component

an occurrence of a product used in an assembled product

NOTE A component may be a piece of equipment or a functional module.

3.7.4

connectivity

the entire arrangement of conductors or networks for joining ports, terminals or other conductors

3.7.5

electrotechnical equipment

the apparatus that supports the distribution, generation, storage, transformation, or utilization of electrical energy

3.7.6

electrotechnical system

a system performing its objectives by using mainly electrotechnical equipment

3.7.7

function block

a base element into which the functionality of an electrotechnical system may be decomposed

NOTE A function block may be decomposed into other function blocks.

3.7.8

functionality

the intended purpose or use of a piece of equipment

3.7.9

human-interpretable string

a sequence of alphanumeric characters intended to be interpreted by humans only, even though the information may be stored or displayed by a computer

3.7.10

GIS position

a position specified through a global information system

3.7.11

industrial system

a system designed or suitable for industrial use

EXAMPLE Systems designed to be used in a production environment with a high resistance against shock or magnetic fields.

3.7.12

interface

a complex access mechanism to the functionality of a component

NOTE In most cases an interface comprises a combination of one or more ports.

3.7.13

occurrence

the use of a typical item at a specific place in a design. Each occurrence is a separate item that refers to the typical item

EXAMPLE Potentiometers is a data class containing catalog items. One instance of the class of potentiometers specifies a potentiometer of type P104 with a resistance of 400 Ohm. The data class of occurrences contains two instances specifying potentiometers R1 and R2 of type P104 that are currently in use. R1 is set to a potential divider ratio of 75% and R2 is set to a potential divider ratio of 10%. Both have the resistance of 400 Ohm because both are occurrences of P104.

3.7.14

port

an access point to a functionality

NOTE Even though, in most cases, a port is implemented by the use of one or more terminals, it is not required for a port to have a physical equivalent.

3.7.15

system

a set of interdependent elements constituted to achieve a given objective by performing a specified function. This includes the equipment used, as well as non-physical items like software, that ensures proper control and interaction of the equipment

3.7.16

terminal

an access point to a piece of equipment

3.8 Abbreviations

For the purpose of this part of ISO 10303, the following abbreviations apply.

- AAM application activity model;
- AIM application interpreted model;
- AP application protocol;
- ARM application reference model;
- ASCII American Standard Code for Information Interchange
- CAD computer aided design;
- GIS geographic information system;
- id identifier;
- RGB a colorimetric system identifying colours by specifying their red, green and blue portions;
- UoF unit of functionality.

4 Information requirements

This subclause specifies the information required for the design, installation, and commissioning of electrotechnical systems.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

NOTE 1 A graphical representation of the information requirements is given in annex G.

NOTE 2 The information requirements correspond to those of the activities identified as being within the scope of this application protocol in annex F.

NOTE 3 The mapping table specified in 5.1 shows how the integrated resources and application interpreted constructs are used to meet the information requirements of this application protocol.

4.1 Units of functionality

This subclause specifies the units of functionality (UoF) for the Electrotechnical design and installation application protocol. This part of ISO 10303 specifies the following units of functionality:

- allocation (AL1);
- classification (CA1);
- conditions (CD1);
- configuration_management (CF1);
- course (CO1);
- designation (DE1);
- dimensioned_documentation (DI1);
- documentation (DO1);
- effectivity_data (EF1);
- external_reference (ER1);
- function_structure (F1);
- functional_connectivity (C1);
- installation (IN1);
- messages (M1);

ISO 10303-212:2001(E)

- network_allocation (NA1);
- organizational_data (OD1);
- physical_connectivity (PC1);
- product_structure (PD1);
- properties (PR1);
- remark (R1);
- schematic_documentation (SC1);
- site (SI1);
- work_management (W1).

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in 4.2.

4.1.1 allocation (AL1)

The allocation UoF defines information that supports assignment of the elements designated in both the function_structure UoF and the product_structure UoF. The allocation UoF provides the relationship between the description of the equipment and the appropriate functional description of that equipment.

NOTE Allocation of connectivity is not in the scope of this UoF.

The following application objects are used by the allocation UoF:

- Functional_unit_allocation;
- Offered_function_allocation;
- Preferred_item_allocation.

4.1.2 classification (CA1)

The classification UoF specifies all concepts to categorize the packages of information contained in the product data. This includes the information about the documents that specify the classification method.

The following application objects are used by the classification UoF:

- Class_reference;
- Classification_association;
- Classification_attribute;
- Classification_system;

- General_classification;
- General_classification_hierarchy.

4.1.3 conditions (CD1)

The conditions UoF describes the information that is specified in requirements levied against the design or its implementation.

NOTE Requirements laid down in textual form, as property values, or as interface requirements are included.

The following application objects are used by the conditions UoF:

- Requirement;
- Requirement_assignment;
- Requirement_document_assignment;
- Requirement_relationship.

4.1.4 configuration_management (CF1)

The configuration_management UoF specifies the concepts for the specification of the planned use of equipment and on the configurations the equipment may be used in. Specification (see 4.2.323) of variants are included in the scope of the configuration_management UoF.

The following application objects are used by the configuration_management UoF:

- Alternative_solution;
- Class_category_association;
- Class_condition_association;
- Class_inclusion_association;
- Class_specification_association;
- Class_structure_relationship;
- Complex_product;
- Complex_product_relationship;
- Component_placement;
- Configuration;
- Descriptive_specification;
- Device_relationship;

ISO 10303-212:2001(E)

- Final_solution;
- Instance_placement;
- Product_class;
- Product_class_relationship;
- Product_component;
- Product_identification;
- Product_specification;
- Product_structure_relationship;
- Solution_instance_assignment;
- Specification;
- Specification_category;
- Specification_category_hierarchy;
- Specification_expression;
- Specification_inclusion;
- Supplier_solution;
- Technical_solution.

4.1.5 course (CO1)

The course UoF specifies the data used to describe a three-dimensional path to specify the path of pieces of equipment.

EXAMPLE Examples for pieces of equipment with an assigned path are cable ducts or wireways.

The following application objects are used by the course UoF:

- Curve_3d;
- Node;
- Node_relationship;
- Path;
- Path_node;
- Path_node_relationship;

- Path_relationship;
- Path_segment.

4.1.6 designation (DE1)

The designation UoF describes concepts used to identify equipment items and function blocks. An item designator may be composed from other designators. The concepts to describe this structure and methods to categorize the constituents of an item designation are in the scope of this UoF. Identification of documents, signals or locations is also addressed by the designation UoF.

The following application objects are used by the designation UoF:

- Document_designation;
- Object_designation;
- Object_designation_relationship;
- Object_reference_designation;
- Signal_designation;
- Terminal_designation.

4.1.7 dimensioned_documentation (DI1)

The dimensioned_documentation UoF specifies concepts to present the electrotechnical system or parts thereof in pictorial or textual form. Dimensioned drawings or schematic diagrams may be used for that purpose.

EXAMPLE Examples for drawings addressed by dimensioned_documentation UoF are installation diagrams, ground plans, etc.

The following application objects are used by the dimensioned_documentation UoF:

- Angular_dimension;
- Chained_dimension_pair;
- Curve_dimension;
- Datum_feature_callout;
- Datum_target_callout;
- Diameter_dimension;
- Dimension;
- Dimension_callout;
- Dimension_line;

ISO 10303-212:2001(E)

- Dimension_line_terminator;
- Dimension_sequence_pair;
- Dimension_symbol;
- Directed_curve;
- Draughting_callout;
- Geometrical_tolerance;
- Geometrical_tolerance_symbol;
- Leader;
- Leader_directed_dimension;
- Leader_terminator;
- Linear_dimension;
- Ordinate_dimension;
- Parallel_dimension_pair;
- Point_marker_symbol;
- Predefined_symbol;
- Projection_line;
- Radius_dimension;
- Structured_dimension_callout;
- Terminator_symbol;
- Unstructured_dimension_callout.

4.1.8 documentation (DO1)

The documentation UoF specifies concepts to present the electrotechnical system or parts thereof in pictorial or textual form using two-dimensional drawings.

NOTE The concepts used to visualize dimensioned drawings are not included in this UoF.

EXAMPLE Examples for drawings addressed by documentation UoF are circuit diagrams, connection lists, terminal diagrams, etc.

The following application objects are used by the documentation UoF:

- Annotation_curve;

- Annotation_element;
- Annotation_placed_annotation;
- Annotation_subfigure;
- Annotation_subfigure_definition;
- Annotation_subfigure_definition_element;
- Annotation_symbol;
- Appearance;
- Cartesian_coordinate_space_2d;
- Colour;
- Curve_2d;
- Curve_appearance;
- Draughting_annotation;
- Draughting_model;
- Drawing;
- Drawing_assignment;
- Drawing_sequence;
- Drawing_sheet;
- Drawing_sheet_layout;
- Drawing_sheet_relationship;
- Drawing_view;
- Externally_defined_hatching;
- Externally_defined_line_font;
- Externally_defined_symbol;
- Externally_defined_text_font;
- Externally_defined_tile;
- Externally_defined_tiling;
- Fill_area;

ISO 10303-212:2001(E)

- Fill_area_appearance;
- Fill_area_boundary;
- Group;
- Group_annotation_element;
- Group_element;
- Hatching_pattern;
- Layer;
- Line_font;
- Model_placed_annotation;
- Point_2d;
- Predefined_colour;
- Predefined_line_font;
- Predefined_text_font;
- Rectangular_area;
- Sheet_placed_annotation;
- Solid_fill_area;
- Sub_group;
- Text;
- Text_appearance;
- Text_font;
- Text_string;
- Tile;
- User_defined_colour;
- User_defined_hatching;
- User_defined_line_font;
- User_defined_symbol;
- User_defined_symbol_definition;

- User_defined_tile;
- User_defined_tiling;
- View_displayed_model;
- View_placed_annotation;
- Visibility.

4.1.9 effectivity_data (EF1)

The effectivity_data UoF provides the capability to represent information concerning the validity of data. The validity of data can be expressed by effectivities that specify time ranges within which data may be used. Retention periods specify how long data have to be kept and when they may be deleted. Both concepts can use explicit dates or dates expressed by events to represent the relevant points in time.

The following application objects are used by the effectivity_data UoF:

- Dated_configuration;
- Duration;
- Effectivity;
- Effectivity_assignment;
- Effectivity_relationship;
- Event_reference;
- Lot_configuration;
- Manufacturing_configuration;
- Product_class;
- Product_identification;
- Product_design;
- Retention_period;
- Serial_configuration.

4.1.10 external_reference (ER1)

The external_reference UoF specifies a reference mechanism to assign additional information to the product data. This information may be available in either electronic or nonelectronic form.

ISO 10303-212:2001(E)

NOTE Content or format of the referenced data need not be in accordance with this part nor with any other part of ISO 10303.

EXAMPLE Simulation data can be assigned to the product data by using the external_-reference UoF.

The following application objects are used by the external_reference UoF:

- Coded_size;
- Digital_document;
- Digital_file;
- Document;
- Document_assignment;
- Document_content_property;
- Document_creation_property;
- Document_file;
- Document_file_relationship;
- Document_format_property;
- Document_location_property;
- Document_size_property;
- Document_type_property;
- Document_representation;
- Document_structure;
- Document_version;
- Document_version_relationship;
- External_file_id_and_location;
- Hardcopy;
- Language;
- Physical_document;
- Rectangular_size;
- Specific_document_classification.

4.1.11 function_structure (F1)

The function_structure UoF specifies the concepts for the description of the functional decomposition of an electrotechnical system. The data describes a segment of an electrotechnical system independent of the specific product used in that segment. The functionality that the segment is to perform is identified. The functions may be either primitive, i.e., its internal structure is not further described, or it may be composed from other functions.

NOTE The concepts for the specification of the connectivity among the function blocks are not part of the function_structure UoF.

The following application objects are used by the function_structure UoF:

- Composition_relationship;
- Function_definition;
- Function_definition_relationship;
- Function_unit;
- Function_unit_relationship;
- Function_version;
- Function_version_relationship;
- Functionality;
- Single_function_unit;
- Specified_function_unit.

4.1.12 functional_connectivity (FC1)

The functional_connectivity UoF specifies all those concepts that are required to specify the connectivity among the function blocks describing an electrotechnical system. The specification of the interface through which a function block can be interconnected with other function blocks and the concepts to specify the connectivity among them are included.

EXAMPLE Figure 4 shows the functionality of a gas-insulated switchgear. The functionality is described by the function_structure UoF and functional_connectivity UoF. The product data that describes the switchgear comprises concepts from product_structure UoF and physical_connectivity UoF.

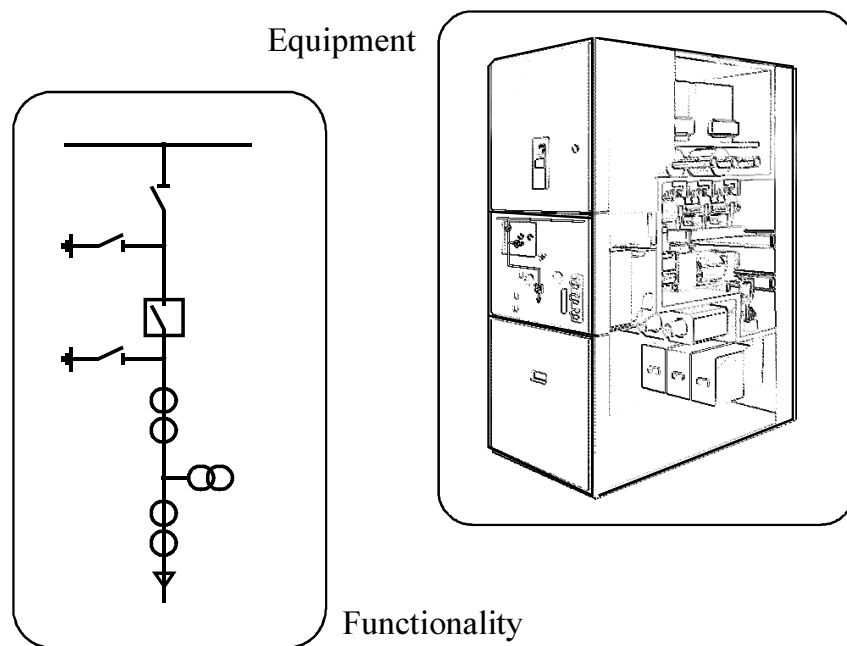


Figure 4 - Functionality of a gas - insulated switchgear

The following application objects are used by the functional_connectivity UoF:

- Function_interface;
- Functional_connectivity_definition;
- Functional_connectivity_definition_relationship;
- Interface_port;
- Interface_port_relationship;
- Interface_port_connectivity;
- Network;
- Port;
- Port_association;
- Port_relationship;

4.1.13 installation (IN1)

The installation UoF describes the arrangement of the items that make up the electrotechnical system. The data needed for cable routing and cable pulling is in the scope of the installation UoF. Concepts that specify routes are also in the scope of the installation UoF.

EXAMPLE Figure 5 shows sectional views of an electrical installation using cabletrays and control cabinets. The arrangement of the equipment and the laying of the cables is described by using concepts from installation UoF, course UoF, and site UoF.

NOTE The content of the text shown in Figure 5 is for presentation purposes only. Its meaning is not essential for this part of 10303.

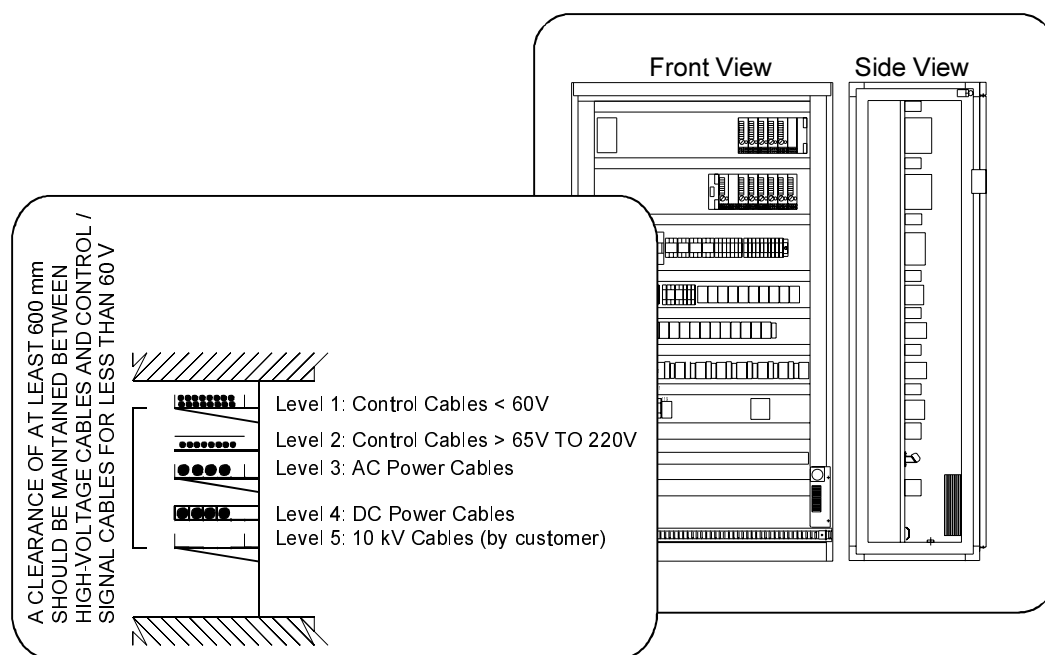


Figure 5 - Example of an installation; installation of devices on cabletrays or in cabinets

The following application objects are used by the installation UoF:

- Cable_pull_information;
- General_location_relationship;
- Free_segment;
- Route;
- Route_relationship;
- Routed_object;
- Routed_segment;
- Section;
- Section_end;

ISO 10303-212:2001(E)

- Section_interface;
- Section_interface_relationship;
- Section_relationship.

4.1.14 messages (M1)

The messages UoF specifies the concepts used to describe the flow of information within an electrotechnical system. The concepts to specify the physical representation of the information within the system and the concepts that specify the information content are included. The physical parameters that cause the information flow can be also described.

The following application objects are used by the messages UoF:

- Notification;
- Notification_relationship;
- Preferred_equipment_assignment;
- Process_variable;
- Process_variable_relationship;
- Process_variable_system_assignment;
- Signal;
- Signal_relationship;
- Signal_system_assignment;
- Signal_value.

4.1.15 network_allocation (NA1)

The network_allocation UoF defines information that supports the allocation of functional connectivity information to the connectivity established by the equipment used in the electrotechnical system. This includes the data to relate the functional connect nodes to their physical counterparts.

The following application objects are used by the network_allocation UoF:

- Connectivity_allocation;
- Port_allocation;
- Preferred_item_terminal_allocation.

4.1.16 organizational_data (OD1)

The organizational_data UoF specifies the concepts to assign organizational information to the product data. This information provides the basis for the management of the product data.

EXAMPLE Examples for organizational information are approval information, information about ownership, time stamps, etc.

The following application objects are used by the organizational_data UoF:

- Address;
- Approval;
- Approval_relationship;
- Approval_status;
- Certification;
- Date_and_person_assignment;
- Date_and_person_or_organization;
- Date_time;
- Date_time_assignment;
- Date_time_interval_assignment;
- Duration;
- Organization;
- Organization_relationship;
- Person;
- Person_in_organization;
- Person_in_organization_relationship;
- Person_organization_assignment;
- Security_classification;
- Security_level;
- Time_interval.

4.1.17 physical_connectivity (PC1)

The physical_connectivity UoF specifies the concepts required to specify the connectivity among the equipment within an electrotechnical system. The specification of the interface through which a piece

ISO 10303-212:2001(E)

of equipment may be interconnected with other devices and the concepts to specify the connectivity among the equipment are included.

EXAMPLE Figure 6 shows a wiring harness of a vehicle. To describe its assembly structure and connectivity concepts of product_structure UoF and physical_connectivity UoF are used.

NOTE The content of the text shown in Figure 6 is for presentation purposes only. Its meaning is not essential for this part of 10303.

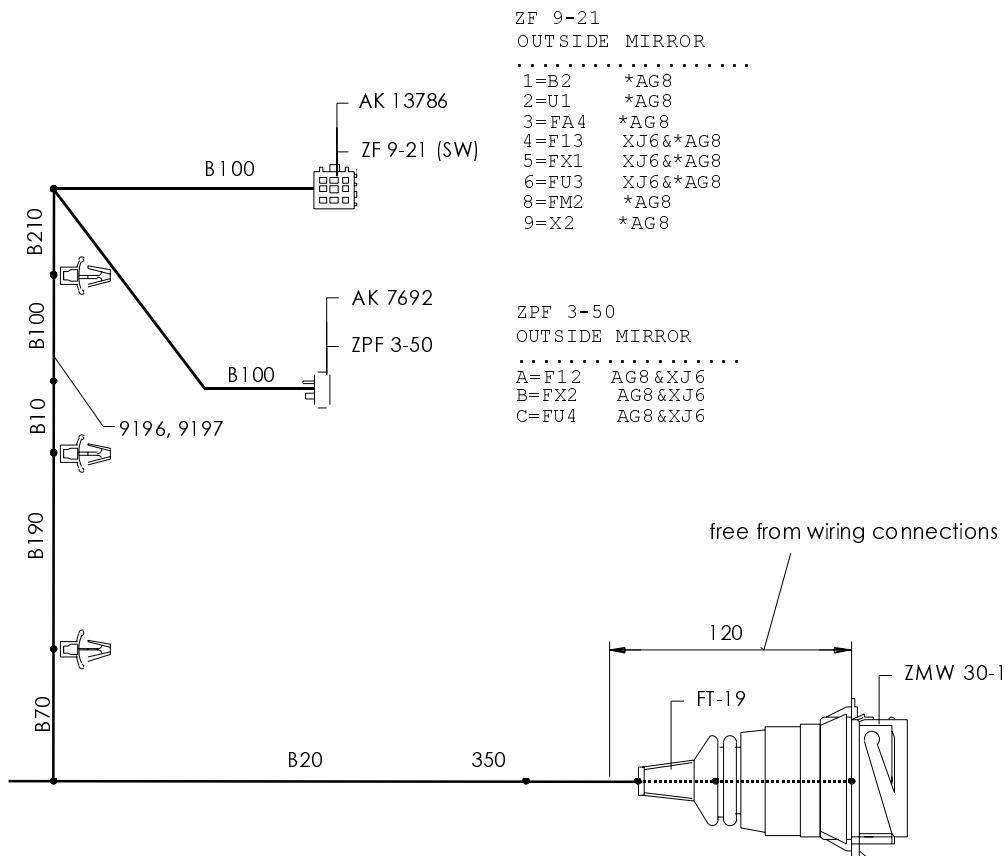


Figure 6 - Example of a product description: output of a wiring harness

The following application objects are used by the physical_connectivity UoF:

- Connection;
- Connectivity_definition;
- Connectivity_definition_relationship;
- Interface;
- Interface_terminal;
- Interface_terminal_relationship;
- Interface_terminal_connection;

- Predefined_connection;
- Terminal;
- Terminal_relationship.

4.1.18 product_structure (PD1)

The product_structure UoF specifies the concepts for the description of the hierarchical structure of the equipment used within an electrotechnical system.

NOTE The concepts for the specification of connectivity among products are not part of the product_structure UoF.

The following application objects are used by the product_structure UoF:

- Alias_designation;
- Alias_identification;
- Alias_version;
- Alternate_item_relationship;
- Application_context;
- Assembly_component_relationship;
- Assembly_substitute_relationship;
- Assembly_definition;
- Component_placement;
- Design_discipline_item_definition;
- Device;
- Item;
- Item_definition_relationship;
- Item_identification;
- Item_version;
- Item_version_relationship;
- Make_from_relationship;
- Next_higher_assembly;
- Numerical_precision;

ISO 10303-212:2001(E)

- Part;
- Physical_assembly_relationship;
- Physical_instance;
- Product_constituent;
- Promissory_usage;
- Quantified_device;
- Selected_device;
- Shape;
- Shape_assignment;
- Single_device;
- Specific_classification_hierarchy;
- Specific_item_classification;
- Specific_item_classification_hierarchy;
- Specified_device;
- Technical_system;
- Technical_system_relationship.

4.1.19 properties (PR1)

The properties UoF specifies a generic concept to assign technical or management data to the information packages that make up the product data.

The following application objects are used by the properties UoF:

- Aggregated_value;
- Binary_value;
- Body_breadth;
- Body_height;
- Body_length;
- Component_colour;
- Cross_section;

- Data_element;
- Data_element_association;
- Data_element_definition;
- Data_element_definition_relationship;
- Data_element_relationship;
- Data_element_specification;
- Data_element_value;
- External_library_reference;
- Format_of_value;
- Logical_value;
- Mass;
- Material;
- Mounting_features;
- Numerical_value;
- Operating_temperature;
- Outside_diameter;
- Predefined_data_element;
- Property_reference;
- Rated_current;
- Rated_power;
- Rated_voltage;
- Single_value;
- Storage_temperature;
- String_value;
- User_defined_data_element.

4.1.20 remark (R1)

The remark UoF specifies the concepts to associate additional human-interpretable information to the product data. Markings applied to the equipment are also supported by the remark UoF.

EXAMPLE Examples for the information supported by remark UoF include information such as comments, assembly instructions, manufacturing instructions, etc.

The following application objects are used by the remark UoF:

- Generic_note;
- Linear_pattern_location;
- Marking;
- Multi_language_note;
- Note;
- Note_association;
- Set_of_notes.

4.1.21 schematic_documentation (SC1)

The schematic_documentation UoF specifies the concepts used to present product data in schematic diagrams.

NOTE The concepts used to visualize dimensioned drawings are not included in this UoF.

EXAMPLE Examples for schematic constructs are symbols, schematic connections, or cross references.

The following application objects are used by the schematic_documentation UoF:

- Cartesian_coordinate_space_with_grid;
- Connect_area;
- Connecting_line;
- Cross_reference;
- Detached_representation_reference;
- Direction_range;
- Item_presentation;
- Note_reference;
- Page_connector;

- Page_connector_presentation;
- Page_connector_reference;
- Reference_grid;
- Reference_grid_layout;
- Schematic_node;
- Schematic_text;
- Typical_schematic_node;
- Typical_schematic_text.

4.1.22 site (SI1)

The site UoF describes the location where the equipment is positioned. Location (see 4.2.192) is understood as a defined volume of space that contains equipment. Hierarchical decomposition of locations or neighbourhood relationships between locations are supported. Global positioning system data may be applied to specify the three-dimensional position.

The following application objects are used by the site UoF:

- Cartesian_point;
- Cartesian_coordinate_space_3d;
- General_location_relationship;
- Gis_position;
- Hierarchical_location_relationship;
- Location;
- Location_assignment;
- Location_relationship;
- Neighbourhood_location_relationship.

4.1.23 work_management (W1)

The work_management UoF specifies the concepts for activity specific, project specific, and contract specific information. This UoF also supports concepts to keep track of changes that result from various activities throughout the lifecycle of an electrotechnical system.

The following application objects are used by the work_management UoF:

- Activity;

ISO 10303-212:2001(E)

- Activity_element;
- Activity_method;
- Activity_method_assignment;
- Activity_relationship;
- Contract;
- Organization_in_contract;
- Project;
- Project_relationship;
- Work_order;
- Work_request.

4.2 Application objects

This subclause specifies the application objects for the Electrotechnical design and installation application protocol. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

4.2.1 Activity

An Activity is the fact of achieving or accomplishing an action.