Report of IEC 17B/MT15
Presented to the LVSD Subcommittee May 5, 2004
By Shaun P. Slattery

There have been 2 meetings concerning 17B MT15 formerly WG5 since our last report.

The first meeting was held as a phone conference with the USNC TAG

MEETING: USNC Technical Advisory Group for IEC SC17B/MT15
DATE AND TIME: Tuesday, 13 April 2004, 11:00 am – 12:26 pm
PLACE: Conference Call
The minutes of this meeting are attached.

The second meeting was held in Palermo, Italy April 20-22, 2004.
The principal items of interest as highlighted in the minutes (attached) are as follows:

1) <u>Device Profiles</u>

- Mr. Wayne Weilebski (USA), Rockwell Automation, gave a presentation on IEC 61915 which deals with the development of Device Profiles for Networked Industrial Devices.

- MT 15 agreed to establish a task force to begin the work of developing device profiles in documentation in accordance with IEC 61915. Italy and France have agreed to participate on the task force and the convenor requested the remaining members of MT 15 to consider nominating experts to participate.

    > **ACTION : Can the USA identify an appropriate device profile expert to participate on the**
    > **IEC 17B/MT15 Device Profile Task Force ?**

- Comments are requested on the two papers which have already been submitted, IEC 17B/MT15(Hahn)01/04 and IEC17B/MT15(Nereau)01/04, which are attached as PALERMO (03) and PALERMO (04), respectively. These were submitted by France and Germany.

    > **ACTION : The USA TAG should not only comment on both papers but should also consider submitting it's own document on device profiles**

Respectfully submitted by,

Shaun P. Slattery

Item 6

Although I did not draft a letter to members of IAS inviting corresponding members for LV standards, I did extend an invitation to the members of the I&CPS Low Voltage protection subcommittee to forward their names if they would like to be advised when work is starting on a revision of a document. No immediate takers.

<u>**MINUTES**</u>

MEETING: **USNC** Technical Advisory Group for IEC SC17B/MT15
DATE AND TIME: Tuesday, 13 April 2004, 11:00 am – 12:26 pm
PLACE: Conference Call

<u>**Members Present**</u>
B. DiMarco   Siemens
K. Gettman   NEMA
R. Hames   Underwriters Laboratories
C. Kimblin   Eaton Electrical
P. Piqueira   General Electric
W. Stoppelmoor   Square D
J. Young   Siemens

PRESIDING OFFICER: Phil Piqueira, Technical Advisor

1.   <u>Purpose of the Meeting</u>
        To review the agenda for the next meeting of SC17B/MT15, particularly the following
        items:
        • Comments on 17B/1320/CD
        • EMC
        • Profiles

2.   <u>Discussion</u>

17B/1320/CD – members reviewed the technical comments submitted by other National
Committees and developed a position for the experts to use at the meeting. A copy of the
compilation of comments and suggested US position is provided with the distribution of these
minutes.

EMC – there were no particular areas of concern with the draft documents to be discussed at the
meeting.

Profiles – it was noted that this is in the very early stages of discussion. A presentation was to be
made at the meeting to identify the key concepts of communication profiles and how they may be
used with the equipment under this committee. A copy of IEC 61915 is available on the NEMA
Forum under SC17B Members Only. If you cannot see this conference, please contact Ken
Gettman.

3.   <u>NEXT MEETING, ADJOURNMENT</u>
        The next meeting will be called based on needs of the TAG.

        The meeting was adjourned at 12:26 pm.

Reported by:

Ken Gettman - NEMA
Manager, International Standard
Tel: 703-841-3254   e-mail: ken_gettman@NEMA.org

<u>**REPORT OF INTERNATIONAL MEETING**</u>

<u>DATE</u>: April 28, 2004   DELEGATES: B. DiMarco

                                                  P.   Piqueira

<u>REPORT OF MEETING</u>: IEC 17B Maintenance Team 15

<u>DATE AND PLACE</u>: Palermo, Italy
                        April 20-22, 2004

<u>COUNTRIES/DELEGATES ATTENDING</u>:

<u>FRANCE</u>:	J. Nereau, Schneider M. Delaplace, Secretary 17B
<u>GERMANY</u>:	M. Hahn, Siemens
<u>ITALY</u>:	A, Sciani, Nuova Magrini Galileo L. Azzola, ABB Sace- Italy S. Bisello, Bticino-Italy
<u>JAPAN</u> :	S. Yamagata, Mitsubishi Electric Co.
<u>SOUTH AFRICA</u> :	I. Kruger, CBI
<u>SWITZERLAND</u> :	H. Weichert, Rockwell Automation
<u>UNITED KINGDOM</u>:	P. Galbreath, Merlin-Gerin R. Upton, Eaton Electric (Convenor)
<u>U.S.A.</u>:	B. DiMarco, Siemens P. Piqueira, GE
<u>Apologies</u> :	V. Kreuziger, Moeller (Germany) R.Ritzma, Eaton Electric (Finland) T. Baiatu, ABB/CMC (Germany)
<u>Guests</u> : Expert) (4/22 only) (4/22 only) only)	W. Wieblowski, Rockwell, USA (Device Profiles Name Unknown, France (Device Profiles Expert) Name Unknown, Italy (Device Profiles Expert) (4/22

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IMPACT STATEMENT

MT15 consists of experts from various countries which have the assigned responsibility from sub-committee 17B for the development of low voltage standards covering industrial molded case and power circuit breakers defined by separate UL, NEMA, and ANSI domestic standards.

RATIONALIZATION FOR PARTICIPATION

The development of any new standard or related appendix involving the above mentioned product lines could greatly affect future domestic designs and marketing decisions. Active participation is required to insure that present USA application and safety requirements are not jeopardized.

OVERVIEW OF MEETING

The meeting was essentially conducted in line with the chairman's agenda, SC 17B/MT15(Convenor) 06/04, attached as PALERMO (01).

IEC 17B/WG5 Meeting-Palermo, IT   Page 2
April 20-22, 2004

General

- Mr. Garcia has left AFME and no replacement from Spain has yet been specified.

2) Consideration of the comments received on 17B/1320/CD, proposed 1st amendment 1 to 60947-2

- The comments associated with the proposed first amendement of IEC 60947-2 (IEC 17B/1342/CC) were reviewed.

- The USA comment to modify Table X was ''not accepted for the time being''. There were implications associated with sequence IV. Consequently, the USA agreed to draft a proposal re-writing sequence IV, taking into account item 5) of Nereau-sequence I (October 12, 2003). It was also suggested that the Combined Sequence be referred to as Sequence VI.

- There were also several comments associated with the acronym for the Instantaneous Trip Circuit Breakers (Annex O) and it was agreed to revert back to the previous acronym, ICB.

- The resolution of the comments are attached as PALERMO (02). Although it was planned for this document to be issued as a CDV, it will now be issued as a CD in order to include EMC clauses as discussed under agenda item 5.

3) Dielectric Verifications in 60947-2

- During the previous meeting in Zurich, Mr. Weichert, raised the issue concerning discrepancies which exist in the dielectric withstand requirements between Part 1 and Part 2. It appeared that much of the discrepancy was associated with the cross-referencing between the two documents. The chairman drafted a document, IEC 17B/MT15 (Convenor) 04/04, which places the requirements entirely in Part 2 in order to eliminate the cross-referencing.

- MT15 agreed with the document and, consequently, these requirements will be included in amendment 1.

4) IEC 17B-60947-2 Ed3 PUB-CZE

- The Czech Republic submitted several miscellaneous comments on IEC 60960-2 which were, primarily, editorial. Most of the comments were accepted and will be included in amendment 1.

5) Annex M

- Mr. Nereau raised an issue concerning Clause M.8.14.3.1 in the proposed 1st amendment of IEC 60947.2. The paragraph refers to $I_{delta\ w}$ instead of I_{cw}. Mr .Nereau pointed out that I_{cw} should be the correct reference because the test is not a residual current test. MT15 agreed that this correction will be included in amendment 1.

6) EMC clauses in 60947-2

- The EMC provisions for Annex B, Annex F, Annex J, and Annex M have been updated (SC 17B/MT15 (UK)02/04, 03/04 , 01/04, and 04/04) and were reviewed

  While there was general agreement on the documents, the figures associated with Annex F have not been completed yet and the EMC provisions cannot be completed until the figures are reviewed. However, it

was also agreed that it would be beneficial to include the EMC proposals as part of Amendment 1. Therefore, in order to include this CD as part of the first amendment, the figures and text will be sent to the secretary by the end of June, 2004 and a new, combined CD will be circulated for comments by the middle of September, 2004.

7) Device Profiles

- Mr. Wayne Weilebski (USA), Rockwell Automation, gave a presentation on IEC 61915 which deals with the development of Device Profiles for Networked Industrial Devices.

- MT 15 agreed to establish a task force to begin the work of developing device profiles in documentation in accordance with IEC 61915. Italy and France have agreed to participate on the task force and the convenor requested the remaining members of MT 15 to consider nominating experts to participate.

> **ACTION : Can the USA identify an appropriate device profile expert to participate on the**
> **IEC 17B/MT15 Device Profile Task Force ?**

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> **ACTION : The USA TAG should not only comment on both papers but should also consider submitting it's own document on device profiles**

8) Any Other Business

- Mr. Yamagata submitted IEC SC17B/MT15 (Yamagata)01/04 dealing with editorial corrections to Table 9, Overall scheme of test sequences. MT15 agreed with the proposed changes and these will be included in the combined CD to become Amendment 1.

- Mr. Weichert submitted a document, IEC SC 17B/MT15 (Weichert) 01/04, suggesting that the marking on instantaneous trip circuit breakers (Annex O) be a symbol instead of the acronym, ICB. However, MT15 was not

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able to reach concensus on this issue and the acronym, ICB, will be retained.

- The suggestion was raised by Mr. Galbreath that perhaps IEC 60947-2 was becoming too cumbersome and should be split into several parts. Mr. Upton will raise the suggestion with the advisory group and prepare some suggestions on how that might be accomplished if MT 15 were to procede in that direction.

- EN50011 is the terminal marking scheme for contactors and, as such, is an issue which will not be of concern to MT 15.

- Critical Currents is an issue which originated with DC contactors. The advisory group asked MT 15 if this is an issue which needs to be addressed by MT 15. At this juncture, this is an issue which MT 15 does not feel the need to react to.

- 23E Liaison-Paul Galbreath delivered a report on the activities of SC 23E

8) **Forthcoming Meetings**

- December 14-16, 2004 : Delft, Netherlands
- September 27-29, 2005 : Berlin, Germany

P.M. Piqueira   B. DiMarco

PALERMO (01)

Meeting of MT15 in Palermo 20th-22nd April 2004

Commencing at 09.00 on the 20th

AGENDA

1. Consideration of the comments received on 17B/1320/CD, proposed 1st amendment to 60947-2 – paper to follow.

2. Dielectric verifications in 60947-2 – to consider 17B/MT15 (Convener) 04/04

3. IEC 17B – 60947-2-Ed3 PUB-Cze – to consider these comments on the third edition, from the Czech Republic – paper attached

4. Annex M – to consider comments by J-P Nereau – paper attached

5. EMC clauses in 60947-2

    a) To review the text of the proposed revision as presented in the attached papers, considering the text only:
    17B/MT15 (UK) 01,02,03 & 04 /04
    Note: These have already been seen by the EMC experts

    b) To review the Figures for the proposed amendment, if available.

    c) To consider the queries raised in 17B/MT15 (Convener) 03/04 attached

    c) To decide how to proceed with this subject.

6. Device Profiles (To be first/only item on Thursday 22nd)

    a) Presentation by Wayne Weilebski of Rockwell

    b) 17B/MT15 (Hahn) 01/04 - to consider this proposal.

    c) To decide how to proceed with this subject.

7. AOB

    a) EN50011 - To consider whether this is acceptable in IEC

    b) Critical currents - switching of low DC currents is being addressed in WG2 – to consider any implications for circuit-breakers

8. Forthcoming meetings

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PALERMO (02)

17B/1342/CC

COMPILATION OF COMMENTS ON COMMITTEE DRAFT

Project number:	Reference number of the CD
IEC 60947-2, A1, Ed.3.0	**17B/1320/CD**
IEC/TC or SC	Date of circulation
SC 17B	**2004-03-26**

Title of the TC or SC:
Low-voltage switchgear and controlgear

Title of the committee draft:
Amendment 1 to IEC 60947-2, Ed.3.0: Low-voltage switchgear and controlgear - Part 2: Circuit-breakers

The above-mentioned document was distributed to National Committees with a request that comments be submitted

Comments received – see annex [1]

DECISION OF THE CHAIRMAN (in cooperation with the secretariat)

a ☐ A revised committee draft will be distributed as a committee draft for vote (CDV) by (date) ……….

b ☐ A revised committee draft will be distributed for comment by (date) ……….

c ☒ The committee draft and comments will be discussed at the next meeting (date) **(MT15 meeting) 2004-04**

NOTE   In the case of a proposal *a* or *b* made by the chairman, P-members objecting to such a proposal shall inform the Central Office with copy to the secretary in writing within 2 months of the circulation of this compilation (see ISO/IEC Directives, Part 1, 2.5.3).

Name or signature of the Secretary	Name or signature of the Chairman
Marcel DELAPLACE	

Annex

Date	Document
2004-03-26	17B/1320/CD

National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
AT 1 (1)			General	The Austrian Electrotechnical Committee supports the above mentioned document.	Noted
DK 1 (2)			General	The Danish National Committee supports the document but has the following comment to offer:	Noted
FR 1 (3)			General	The French National Committee submits the following comments.	Noted
PT 1 (4)			General	The Portuguese NC approves 17B/1320/CD	Noted
ZA 1 (5)			General	The South African National Committee has no comments on this stage.	Noted
ES 1 (6)			General	The Spanish National Committee does not have any comments at present time.	Noted
SE 1 (7)			General	We have no comments to this document.	Noted
GB 1 (8)			General	The British Electrotechnical supports the principles and philosophy of the draft.	Noted

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National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
FR 2 (9)	2.20		Editorial	This definition related to the « nominal » rating is confusing with the maximum threshold at 120% defined for single pole test (see 8.3.3.1.2, 5th paragraph). **Proposed change:** Modify the term and the definition as follows : rated instantaneous tripping current (I_i) rated value of the current causing the operation of a release without any intentional time-delay and within a time not exceeding 0,2 s. Delete the note. Modify consequently Annexes K and L. See also comments FR - 4 and 5.	Accept-Must also be correlated in Annex K and Annex L
IT 1 (10)	2.20		Technical	Definition of "instantaneous tripping current" in this document does not correspond to what is usually intended as limit of tripping/non tripping currents in the general application for CB. It is necessary to specify that this definition applies only to MCP of "annex O" **Proposed change:** Add at the end of the definition this note: "NOTE 2: This definition applies only to MPC of Annex O"	Accepted in Principle (c0vered by FR (2); however, the reference to clause 2.20 will be specified whenever instantaneous tripping current is mentioned
FR 3 (11)	8.3.1		Technical	Tests have to be made at the conventional non-tripping and tripping current only. **Proposed change:** Modify the new dashed item as follows : - tripping limits and characteristics (8.3.3.1); in which case the sample(s) tested in the sequence shall be subjected to the tests of 8.3.3.1.3, at the maximum setting only and without the time-current characteristic verification of item b);	Accept with slight modification

National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
FR 4 (12)	8.3.1		Editorial	In addition to comment FR - 3, this paragraph relating to sequence I should be moved to sequence I. **Proposed change:** The 3rd paragraph of 8.3.1 of the present standard starting with « With reference to 8.1.1 of Part 1, … » and finishing with « (8.3.3.3.5). » should be moved at the end of 8.3.3.	Accept in principle-Add a reference to see 8.3.1 in Table 9 as a footnote "For tests that may be omitted under sequence 1 and done on separate samples.
DE 1 (13)	8.3.1	new dash item	Technical	Make the requirement more clear **Proposed change:** - tripping limits and characteristics (8.3.3.1); With one sample, performing the tests of 8.3.3.3 to 8.3.3.9, the tests of 8.3.3.1.3 shall be made at the maximum setting only.	Covered by FR (03)
CN 1 (14)	8.3.2.1		Technical	Because the test condition of four-pole circuit-breakers is more rigorous than that of three-pole circuit-breakers , so when the basic structure of four-pole circuit-breakers is the same as three-pole circuit-breakers, three-pole circuit-breakers shall not be tested again after four-pole circuit-breakers passed the type test. **Proposed change:** Add, after the second paragraph, the following new paragraph: When the basic structure of four-pole circuit-breakers is the same as three-pole circuit-breakers, three-pole circuit-breakers shall not be tested again after four-pole circuit-breakers passed the type test.	Not accepted-There is evidence that this is not always technically valid.

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National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
US 1 (15)	8.3.2.1	Table 10	Technical	The present table X requires that all short circuit tests @ the highest Ue be done only reverse connected, if the circuit-breaker has more than one marked Ue rating and terminals unmarked. Also circuit breakers with one Ue rating and unmarked terminals require an additional sample at all short circuit levels. Table X could be appreciably simplified by limiting reverse connected tests to the highest short circuit levels (typ. Icu and Combined sequences). We also believe that the above proposal will resolve item 5 of JP Nereau's proposal of October 12, 2003 since it would eliminate the need to do rev. connected tests at Icw. **Proposed change:** Based on this rationale, we would propose to revise table X as follows: --Note 3) add to the present wording: *"This sample required only for Sequence II combined and Sequence III- not for sequences II or IV."* --Note 4) add to the present wording: *"Reverse connections apply only to Sequences II Combined and Sequence III – Tests of seq. II and IV to be done forward connected only."*	Not Accepted for the time being-to be the subject of future work. The USA agreed to draft a proposal re-writing sequence IV, taking into account item 5) of Nereau-sequence I (October 12, 2003. It was also suggested that the Combined Sequence be referred to as Sequence VI.
DE 2 (16)		Table 10 Note 10	Technical	Not necessary in Seq I and with the items tested at maximum current. Change the text to make it more clear. **Proposed change:** In column "Notes" add 10.) in the test sequences II,IV,V only in the rows with the note 2.). Alternatively change the text of Note 2.) Insert the text of note 10.) after the end of the existing note	Not Acceptable
DE 3 (17)	8.3.3.1.1		Technical	The new proposal must be covered also by the text of the note. **Proposed change:** Delete the existing first paragraph after the note and insert the proposed text before the note.	Accepted

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National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
FR 5 (18)	8.3.3.1.2 of present standard		Editorial	The term of « short-circuit current setting » is not consistent with the new definition 2.20. **Proposed change:** Replace by « rated instantaneous tripping current » (3 times).	Covered by FR (2)
FR 6 (19)	8.3.3.1.2 of present standard		Editorial	In the last but one paragraph, the term of « tripping current » (including the upper tolerance) is not clear. **Proposed change:** Amend the last but one paragraph (5th) to read : at a value equal to 120 % of the rated instantaneous tripping current declared by the manufacturer …	Not accepted
FR 7 (20)	8.3.3.1.2		Editorial	The 1st paragraph is not very clear. **Proposed change:** Modify it as follows : The operation of multipole short-circuit releases shall be verified by one test <u>only</u> on each combination of two poles in series, of poles having a short-circuit release.	Accepted
US 2 (21)	8.3.3.1.2		Technical	The implication of the change to the first paragraph on page 91 is that even the neutral pole, which is typically rated at a current significantly below the phase poles, would be subjected to a short circuit current at both 80% and 120% of the short-circuit current setting. This would be the case due to the need to test all combinations of two poles in series. **Proposed change:** Modify the wording as follows: - first paragraph pg. 91: "The operation of multipole short-circuit releases shall be verified by one test on each combination of two <u>phase</u> poles in series, of poles having a short-circuit release." - second paragraph pg. 91: "In addition, the operation of the short-circuit releases shall be verified once on each pole<u>, phase and neutral,</u> individually, at the value…"	Accept in Principle-Modify 8.3.3.1.2 General as follows: *For Circuit Breakers having the neutral pole provided with overcurrent release(s) rated differently than the neutral phase pole releases, the verification of these releases shall be made on the neutral pole alone.*

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National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
FR 8 (22)	Annex B	Tables B.1 and B.2	Technical	These new tests are not necessary and difficult to do : ♣ there hasn't been identified problem due to this fact yet, ♣ furthermore this kind of test should be the responsibility of the manufacturer. **Proposed change:** Withdraw these tests or limit these tests at 2 values only : 100 and 500 A.	Not Accepted. Waiting for verification data from IEC 23E.
FR 9 (23)	Annex B	Tables B.1 and B.2	Editorial	The note 2 of table B1 and the note 1 of table B2 from 17B/1293/CD are missing. **Proposed change:** Add these notes. These values apply only if they exceed 5 $I_{\Delta n}$ and do not apply if they exceed the instantaneous trip current.	Accepted: Covered by JP (1)
DE 4 (24)	Annex B	Table B.1 Table B.2	Technical	The Annex B is used also for devices with $I\Delta n$ higher than 500A and other than the proposed preferred values **Proposed change:** Leave the tables unchanged	Accepted-Covered byJP (1)
IT 2 (25)	Annex B	Table B.1	Editorial	Note 2) of document 17B/1293/CD seems to be forgotten: **Proposed change:** Insert a note 3) as follows: "These values apply only if they exceed 5$I_{\Delta n}$ and do not apply if they exceed the instantaneous trip current"	Accepted-Covered by JP (1)

National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
JP 1 (26)	Annex B	Table B.1 Table B.2	Technical	This amendment proposes that the dead spots test may be made only during the test of B.8.2.4.3. The verification of B.8.2.4.3 is carried out at the following tests. ; B.8.2 in the test sequence B, B.8.1.1.2.2, B.8.1.1.2.3, B.8.1.1.2.4, B.8.1.1.2.5, B.8.2.5.1, B.8.2.5.2, and B.8.9.1. The dead spots test will be subjected only during the test of B.8.2.4.3 in the test sequence B. The dead spots test is not necessary to be made in other subclauses (B.8.1.1.2.2 , B.8.1.1.2.3 , B.8.1.1.2.4 , B.8.1.1.2.5 , B.8.2.5.1 , B.8.2.5.2 , and B.8.9.1.). **Proposed change:** Replace the note 2) of Table B.1 by the following 2) The test at 5A, 10A, 20A, 50A, 100A, 200A,and 500A are only made during the test of B.8.2.4.3 in the test sequence B. The test is made once for each value of residual current on one pole only chosen at random. The tests are made at the lowest and highest settings, and at one intermediate setting. Replace the note 1) of Table B.2 by the following 1) The test at 5A, 10A, 20A, 50A, 100A, 200A,and 500A are only made during the test of B.8.2.4.3 in the test sequence B. The test is made once for each value of residual current on one pole only chosen at random. The tests are made at the lowest and highest settings, and at one intermediate setting.	Accept in principle: Leave Tables B.1 and B.2 unchanged. Then add: *B.8.2.4.5 The verification of correct operation at higher residual currents* *The test circuit being calibrated at each of the values of residual operating current IdeltN as listed below, and the switchS1 and the CBR being in the closed position, the residual current is suddenly established for closing swtuch S2.* (Test Values from the present tables) *These values apply only if they exceed 10 Idelta N and do not apply if they exceed the rated instantaneous trip current* *The CBR shall trip during each test* *A measurement of break time is made at each value of I deltaN, no value shall exceed the value for maximum break time @ 10 deltaN.given in Table B.1 or B.2, as applicable.*

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National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
NO 1 (27)	Annex B	Tables B.1 and B.2 (page 159)	Technical	"We want discrimination between non-time-delay type (table B1) and time-delay type (table B2) CBRs. This might require a higher maximum breaking time for the time-delay-type or reduce time for non-time-delay type. **Proposed change:** Table B.2 – Operating characteristic for time-delay-type having a limiting non-actuating time of 0,06 s more then maximum breaking time for non-time-delay type.	Not accepted. The limiting non-actuating time is already covered in the standard
CH 3 (28)	L.3 (60947-2)	Note	Editorial	Change note as follows **Proposed change:** Instead of ….."under consideration" →……are proposed to be considered under Annex O	Accepted
FR 10 (29)	M.7.2.2		Editorial	$I_{\Delta w}$ is missing in the title. Furthermore, this title should be similar to the title of M.7.2.1. **Proposed change:** Replace the title by « Operation in case of a short-circuit ».	Accept. Change title to: *Operation in case of a short circuit condition*
PL 1 (30)	Annex M	Figures M.17, M.18 and M.19	Editorial	MRCD should be explained in the keys. **Proposed change:** Add „MRCD – test object".	Not Accepted
DK 2 (31)	Annex O		Editorial	The change of abbreviation for **I**nstantaneous trip **c**ircuit **b**reaker is not understandable. "ICB" seems to be more suitable (see 17B/1293/CD). **Proposed change:** Replace all "MCP" by "ICB" in this annex.	A

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National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
FR 11 (32)	Annex O		General	This Annex for a circuit-breaker without thermal tripping element is unnecessary. *(see 8.3.2.6.1 d) 2nd paragraph and 4.7.1).* **Proposed change:** Replace this proposal by : ♣ a new classification for circuit-breaker with or without overload releases, ♣ the corresponding markings in 5.2 b). Add to 8.3.3.7 - 8.3.4.4 - 8.3.5.1 - 8.3.5.4 - 8.3.6.1 - 8.3.6.6 - 8.3.7.4 - 8.3.7.8 - 8.3.8.1 - 8.3. 8.6 the following : « This test is not applicable to MCCBs without overload releases ». Insert after the fifth paragraph of 8.3.2.1 the following : « If a circuit-breaker without overload release is derived from the equivalent circuit- breaker only by removing the overload release, no more tests are needed ».	Not Accepted This is a major product line with enough significant differences, that it should be a separate annex
CH 1 (33)	O.1		Editorial	What's stand "M""C""P" for ?	
FR 12 (34)	O.3.2 and O.3.3		Editorial	There is an editorial mistake in the sentence of these clauses. **Proposed change:** Modify each 1st paragraph as follows : MCP's may be assigned a rated making capacity different ~~to~~ from the equivalent circuit-breaker. MCP's may be assigned rated breaking capacities different ~~to~~ from the equivalent circuit-breaker.	Accepted

National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
FR 13 (35)	O.4		Technical	The MCP marking implies that the device is dedicated to motor protection only. The use of instantaneous only CBs is allowed in other cases, for instance : ♣ overload protection ensured by upstream / downstream devices, ♣ overload protection ensured by separate relay ? ♣ … **Proposed change:** Replace « MCP » by acronym« ICP » or use the relevant symbol (S00121 of IEC 60617).	
FR 14 (36)	O.4		Editorial	**Proposed change:** Modify the 2nd paragraph as follows : Rated short-circuit making and breaking capacities shall be marked, where applicable (see O.6.1.1). ~~Where~~ When the MCP is only rated for short-circuit performance in association with a motor starter, contactor or overload relay, the short-circuit ratings of the association shall not be marked on the MCP.	Accepted
DE 5 (37)	O.4		Technical	The general symbol should be unchanged to demonstrate that the device has isolation function **Proposed change:** - for 5.2 b) with the symbol (text) MCP	Not Accepted; text clarified

National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
IT 3 (38)	O.4		Technical	In the Manufacturer's instructions shall be indicated information about the maximum I^2t that the MCP can withstand for a range of currents above the Ii current in order to be coordinated with other protective devices. **Proposed change:** Add the following sentence at the end of the sub-clause: "Manufacturer's shall give information about the max withstand I^2t related to currents above Ii"	Accept in Principle Replace the final paragraph of O.4 with: *The manufacturer shall provide information Manufacturer's instructions shall draw attention to the fact that, below the settings of rated instantaneous tripping current, MCP's are not self-protecting and do provide overcurrent protection to the circuit. Such protection shall be provided separately.* *When the MCP is not associated with a specified device (see O.6.2), the manufacturer shall provide data to permit selection of the overcurrent protective device (e.g. i^2t curve)*
US 3 (39)	O.4		Editorial	To be consistent between testing reference for MCP alone and with other devices, a reference should be added to the test clause for MCP with other devices. **Proposed change:** At the end of the 2nd sentence in the 2nd paragraph, add the following: "(See O.6.2).	Covered by IT (3)
DE 6 (40)	O.6.1.1		Editorial	Make it more clear and bring the paragraphs in the right order **Proposed change:** A sample of each of the maximum and minimum values of the rated current *I*n of each frame size shall be tested. In the case of one or more construction breaks (see 2.1.2 and 7.1.5) within the frame size a further sample is tested at the maximum rated current corresponding to each construction The tests of this subclause are not required if the rated short-circuit characteristics of the shortcircuit releases and the main current paths of the MCP are the same as those of the equivalent circuit-breaker.	Not Accepted

National Committee	Clause/ Subclause	Paragraph Figure/ Table	Type of comment (General/ Technical/Editorial)	COMMENTS	OBSERVATIONS OF THE SECRETARIAT on each comment submitted
US 4 (41)	O.6.1.1		Technical	The introductory paragraph does not address the situation where the MCP is not equivalent to a circuit-breaker but does not have its own short circuit ratings. The implication in this situation is that the MCP is not to be used alone. **Proposed change:** Revise the first paragraph as follows: "The tests of this subclause are not required if: - the rated short-circuit characteristics of the shortcircuit releases and the main current paths of the MCP are the same as those of the equivalent circuit-breaker, or - the MCP is not equivalent to a circuit-breaker and it is not provided with short circuit ratings."	Accept in Principle. Modify the 2nd proposed dash as follows: *The MCP is only rated and tested as an association (see O.6.2)*
FR 15 (42)	O.6.1.2		Editorial	A word is missing in the sentence. **Proposed change:** Modify the paragraph as follows : Tests shall be made <u>according</u> to sequences II and III of this standard except for the tripping tests with overload releases.	Accepted
US 5 (43)	O.6.1.2		Technical	The tests would be applicable for sequence II and sequence II combined. **Proposed change:** Revise the text as follows: "Tests shall be made to sequences II<u>, II combined</u> and III of this standard…"	Not Accepted
CH 2 (44)	O.6.2		Technical	MCP shall withstand the overload currents given in table 9 of IEC 60947-4-1 **Proposed change:** Add clauses " overload current withstand requirements "	Not Accepted Covered by 4th dash of 0.6.2

PALERM0 (03)

1. Scope and object

An application profile usually is an agreement within a family of field devices on a uniform usage of the communication means. Thus a certain level of ability for functional cooperation between devices on the fieldbus can be achieved in order to minimize cost by reducing varieties in communications, control software and engineering. It applies to switchgear and control gear hereinafter referred to as "LVSG" (Low Voltage Switchgear) that are intended to be connected to circuits, the rated voltage of which does not exceed 1000 V a.c. or 1500 V d.c.

The scope of this profile is to guarantee the interoperability between devices of the same class (see clause 2). That means that two or more devices, regardless of the manufacturer, can be replaced with a similar one of a different manufacturer and that all applications involving the replaced device will continue to operate as before the replacement.

This version of the communication profile for circuit breakers mainly covers the data structures for cyclic data exchange. It is possible to develop further versions focusing on a-cyclic data exchange for bulk measurement data, parameters, diagnosis and test.
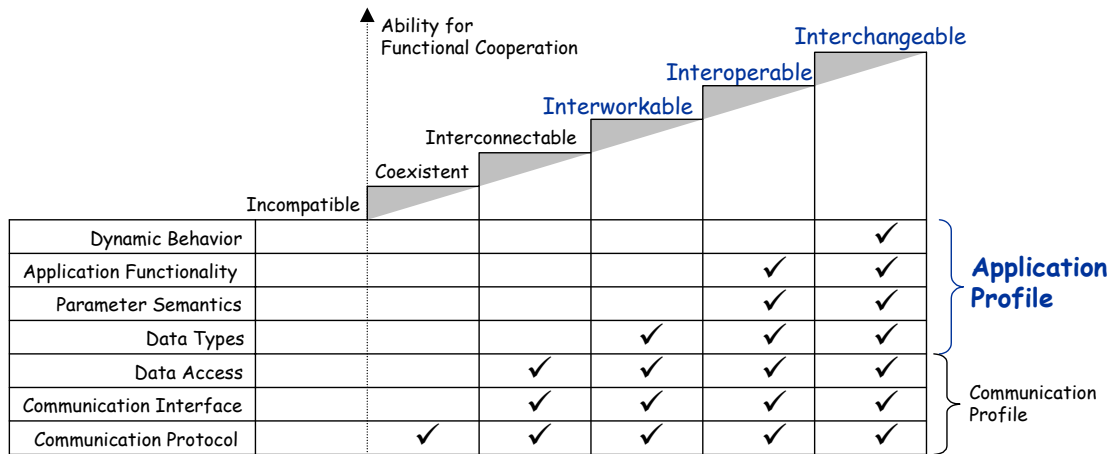
	Incompatible	Coexistent	Interconnectable	Interworkable	Interoperable	Interchangeable
Dynamic Behavior						✓
Application Functionality					✓	✓
Parameter Semantics					✓	✓
Data Types				✓	✓	✓
Data Access			✓	✓	✓	✓
Communication Interface			✓	✓	✓	✓
Communication Protocol		✓	✓	✓	✓	✓

Figure 1   Ability for Functional Cooperation

Terms and Definitions

switchgear and controlgear

general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures (IEV 441-11-01)

switchgear

general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy (IEV 441-11-02)

controlgear

general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for the control of electric energy consuming equipment (IEV 441-11-03)

overload

operating conditions in an electrically undamaged circuit which cause an over-current (IEV 441-11-08)

switching device

device designed to make or break the current in one or more electric circuits (IEV 441-14-01)

NOTE – A switching device may perform one or both of these operations

circuit-breaker

mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short circuit (IEV 441-14-20)

closed position (of a mechanical switching device)

position in which the predetermined continuity of the main circuit of the device is secured (IEV 441-16-22)

open position (of a mechanical switching device)

position in which the predetermined dielectric withstand voltage requirements are
satisfied between open contacts in the main circuit of the device

NOTE – This definition differs from IEV 441-16-23 to meet the requirements of dielectric properties.

over-current relay or **release**

relay or release which causes a mechanical switching device to open with or without
time-delay when the current in the relay or release exceeds a predetermined value

NOTE – This value can in some cases depend upon the rate-of –rise of current

Standards and Directives

The following normative documents contain provisions which, through reference in this
text, constitute provisions of this part of IEC 60947. 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 IEC 60947 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 IEC and ISO maintain registers of currently valid International
Standards.

IEC 60050(151): 1978, *International Electrotechnical Vocabulary (IEV) – Chapter 151:
Electrical and magnetic devices*

IEC 60050(441):1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441:
Switchgear, controlgear and fuses*

Switching, Protection and Distribution in Low-Voltage Networks –
*Handbook with selection criteria and planning guidelines for switchgear, switchboards
and distribution systems*
(English edition of "Schalten, Schützen, Verteilen in Niederspannungsnetzen")
2nd edition, 1994
ISBN 3-89578-0006

IEC 60439-1: 1992, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*

IEC 60445: 1988, *Identification of equipment terminals and of terminations of certain designated conductors, including general rules of an alphanumeric system*

IEC 60447:1993, *Man-machine interface (MM) – Actuating principles*

IEC 60617-7:1983, *Graphical symbols for diagrams – Part 7: Switchgear, controlgear and protective devices*

IEC TS 61915 2003-03, *Low-voltage switchgear and controlgear – Principles for the development of device profiles for networked industrial devices*

Classification

This chapter of the communication profile characterizes the actual circuit breaker classes, the various possible data of field devices, the communications means of BUSSES and other areas of devices that may be specified for standardization. The subset used herein is indicated.

Device Classes

This profile deals with the following low-voltage devices according IEC 60947:

- Circuit Breakers   (IEC 60947-2)
- Overload Relays   (IEC 60947-4)
- Auxiliary Switching Devices   (IEC 60947-5)

Circuit-Breaker (CB)

The term circuit-breaker, in particular a latching switch, is understood to mean a switch which under operating conditions can connect, carry and disconnect the main circuit current. A circuit breaker is comprised of, among other things, a short-circuit release, an overload release and where required, an earth fault release. Dependant on type, the circuit breaker carries out the functions of cable and motor protection, whereby the trip characteristics are dependant upon the particular application. The circuit-breaker can be used, in combination with a contactor, as a motor starter. When supplied with a motor drive the circuit-breaker can be remotely opened and closed. Larger circuit-breakers generally operate via a high speed closing system, which is powered by a manual or automatic spring charger, so that following a switching command the main contacts close immediately. The switching state (on-off) and the breaker state (tripped) can be registered via different auxiliary contacts of the circuit-breaker. Current-transformers for current measuring are integrated into circuit-breakers which contain electronic overload relays. Larger circuit-breakers are generally provided with voltage measurement, and in some cases frequency measurement. With these it is possible for the circuit breaker to register all current / voltage values and current / voltage dependant values (energy, performance etc.). The field of operation for circuit breakers ranges from the switching on and off of small current and power circuits of a few amperes up to large incomers and feeders involving the switching of thousands of amps. Circuit breakers are intended and designed for particular switching conditions.

Thermal Overload Relay (TOL)

The term thermal overload relay is understood to mean a relay that under overload conditions conforms to a time-current curve and which, via a auxiliary contact, causes the switching device (e.g. circuit-breaker or power switch) to interrupt the main current/power circuit.

The overload relay thereby protects the switching device, as well as the cables and any connected loads, against overloads. The time-current curve shares the same heating/cooling characteristics of the equipment protected (motors).

The bimetal strips in the tripping system of a thermal relay are heated proportionally to the current flowing. This provides a characteristic tripping curve. During a strong thermal loading in particular on the bimetal, the overload trips and operates a contact.

Electronic Overload Relay (EOL)

The term electronic overload relay is understood to mean a relay that under overload conditions conforms to a time-current curve and which, via a auxiliary contact, causes the switching device (e.g. circuit-breaker or power switch) to interrupt the main current/power circuit.

The overload relay thereby protects the switching device, as well as the cables and any connected loads, against overloads. The time-current curve shares the same heating/cooling characteristics of the equipment protected (motors).

With an electronic overload relay the current from each phase is read via current transformers, it is then digitized and passes through the internal electronics. Most of these electronic systems contain a microprocessor. It compares the signal against a fixed procedure and produces an impulse on the overload relay, as soon as an overload is detected on the equipment being protected.

Auxiliary Switching Devices

Devices which apply to control circuits for controlling, signalling, interlocking etc., of switchgear and controlgear e.g.

- manual control switches, for example pushbuttons, rotary switches, footswitches, etc.;

- electromechanically operated control switches, either time-delayed, or instantaneous, for example contactor relays;

- pilot switches, for example pressure switches, temperature sensitive switches, programmers, etc.;

- position switches, for example control switches operated by part of a machine or mechanism;

- associated control circuit equipment, for example indicator lights, etc.

Public Device Data

From a communications point of view only device data need to be considered in this profile that are exchanged with master devices or other slaves. These so-called public device data may be classified according to the following Figure 2.
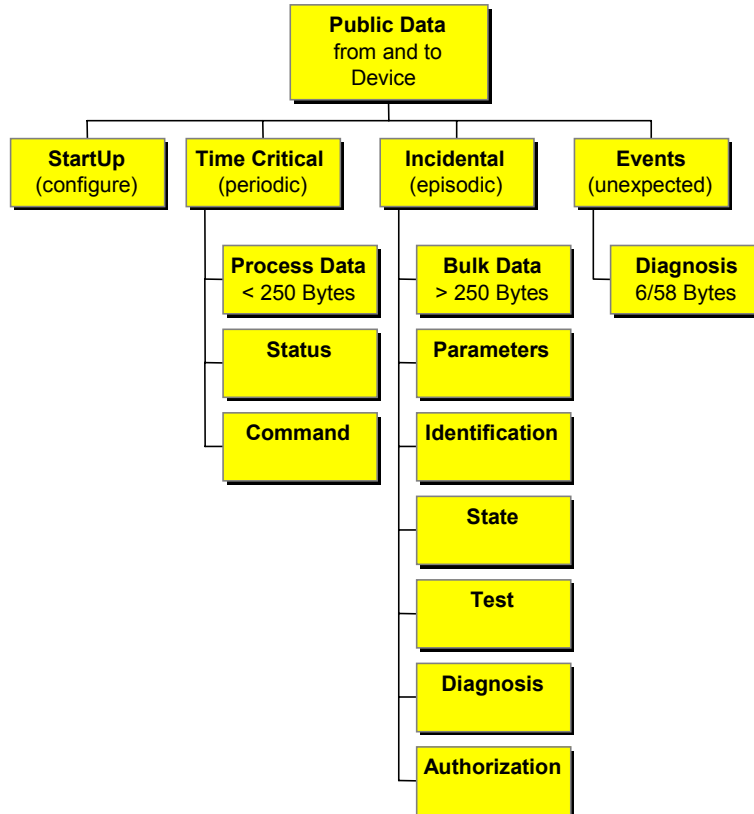
Figure 0 Public Device Data
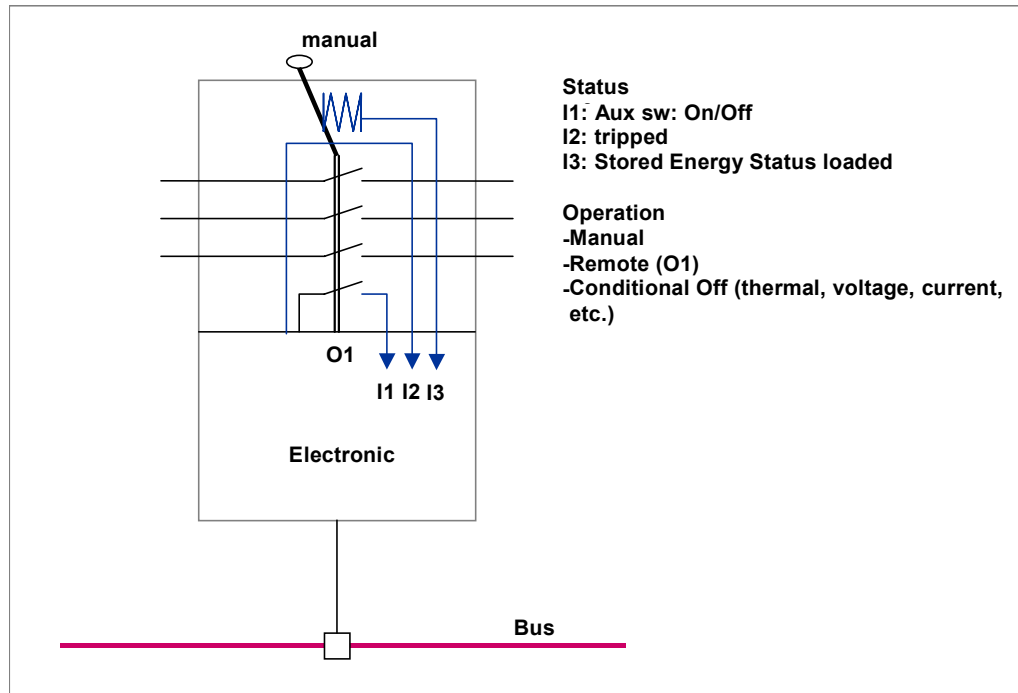
Functional Description

Circuit Breaker

Device Model

Figure 3   Circuit Principle

Figure 3 demonstrates the basic functionality of circuit breaker devices. The circuit breaker may be tripped manually, remotely, or by any overload situation, be it temperature, voltage or current. The main information to be sent to a controller comprises the status of the main contacts, the tripped status and the stored energy mechanism status (if applicable) which provides the force to close contacts in a precise manner. Other information covers availability of the circuit breaker within several functional positions. This profile describes several other useful parameters to supervise the device.

Functional Positions
Breaker not Present
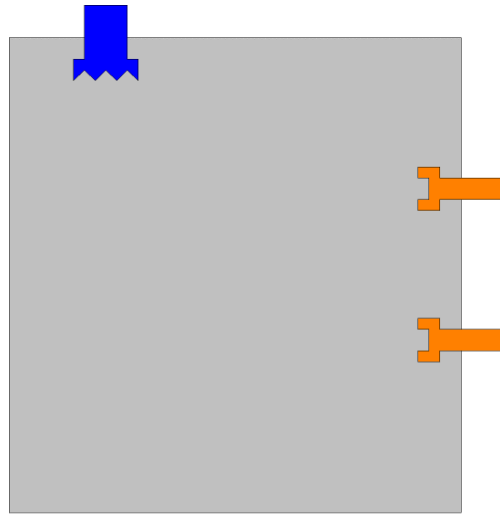
Breaker not present (11)

Figure 0-1   Not present Position

Disconnected Position

Disconnected
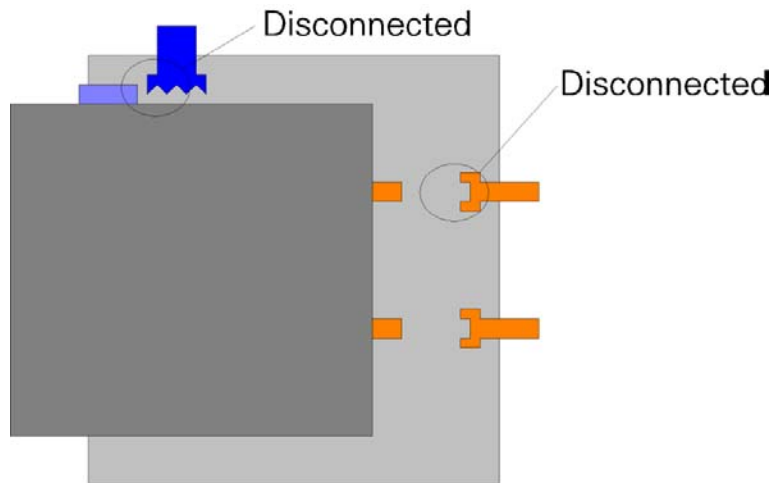
Disconnected

Disconnected position (00)

Figure 0-2   Disconnected Position

Test Position
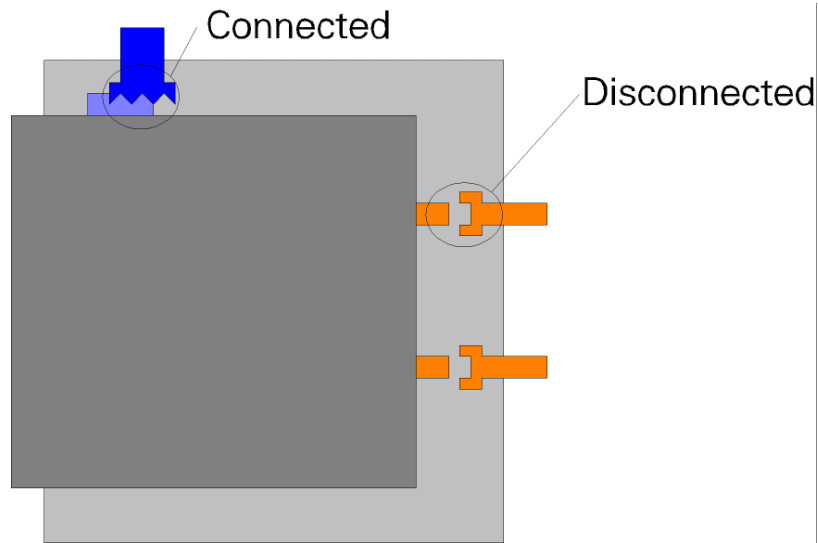
Figure 0-3   Test Position
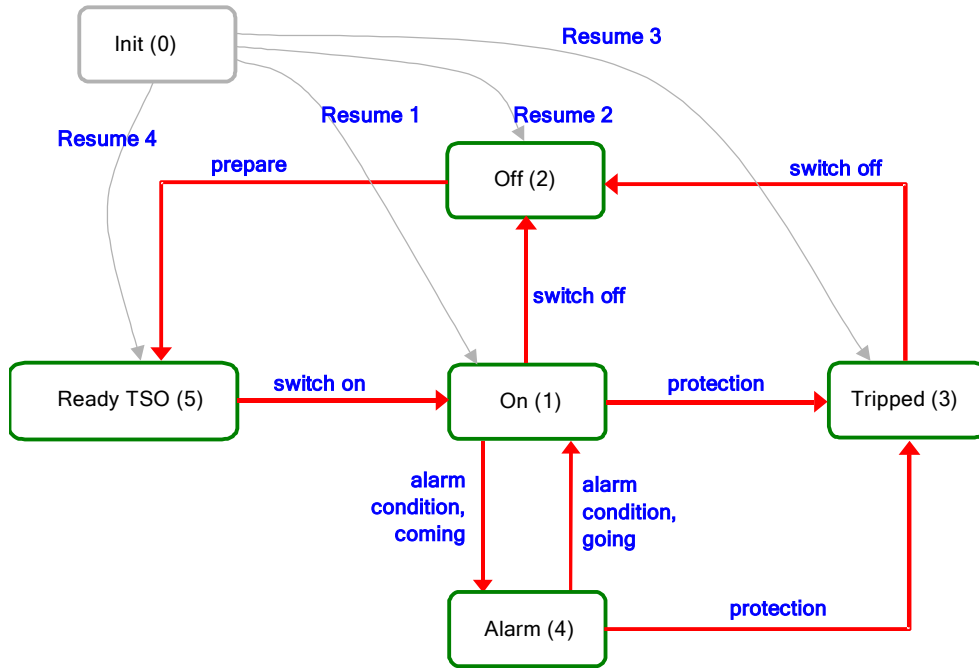
Operating Position
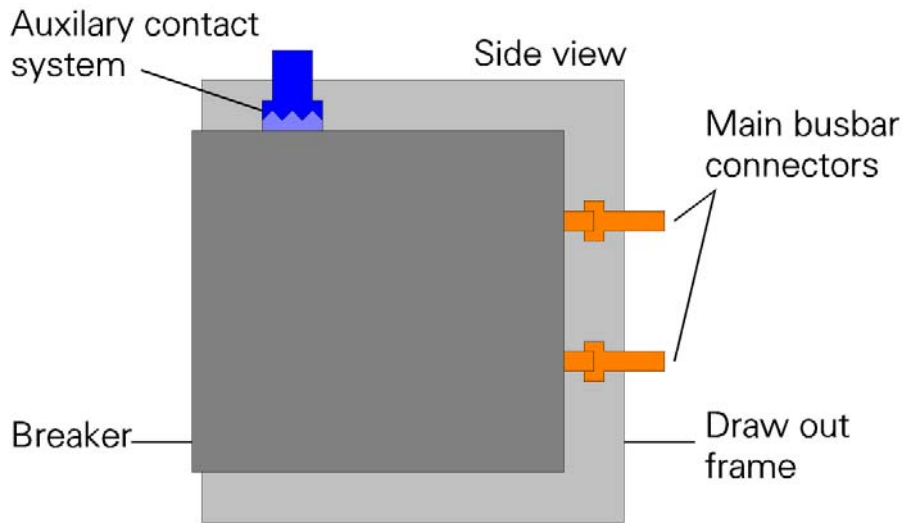
Figure 0-4   Operating Position

Behavior (States)

Figure 4   Operational States of Circuit Breaker

STATE TRANSITION TABLE for Circuit Breaker			
STATE NAME	STATE DESCRIPTION		
Init (0)	Self test; initialization of variables and values; state check		
On (1)	Circuit breaker on , main contacts closed		
Off (2)	Circuit breaker off , main contacts open		
Tripped (3)	Circuit breaker off, main contacts open, optional: trip reset required		
Alarm (4)	Circuit breaker on; main contacts closed; alarm condition exists		
Ready _TSO(5)	Circuit breaker is ready to switch on, main contacts open		
TRANSITION	INITIAL STATE	FINAL STATE	TRANSITION CONDITION
Resume 1	Init (0)	On 1	Circuit breaker is On(1) Note: no tripping condition
Resume 2	Init (0)	Off 2	State check result is Off 2
Resume 3	Init (0)	Tripped 3	Tripping condition exists
Resume 4	Init (0)	Ready TSO 5	State check result is Ready TSO 5 All required conditions for switching on are fulfilled
switch off	On (1)	Off (2)	Switch off
prepare	Off (2)	Ready TSO(5)	All required conditions for switching on get fulfilled
switch on	Ready (5)	On (1)	Contacts are being closed
protection	On (1)	Tripped (3)	Tripping happens
switch off	Tripped (3)	Off (2)	Optional: - tripping condtion removed - trip reset proceeded
alarm condition coming	On (1)	Alarm (4)	Alarm condition exists
alarm condition going	Alarm (4)	On (1)	Alarm condition no longer exists
protection	Alarm (4)	Tripped (3)	Tripping happens

Parameter Definitions

- The parameter definitions are based on IEC definitions within IEC 60947.

- Each name of a parameter is unambiguous in its meaning and if used then in the same way for all device-communication-profiles.

- All parameters (monitoring and command) are high-active if not mentioned else.

Inputs from field device to host controller/master class1

NAME	Data type Units Offset Multiplier Range	Access	DEFINITION NOTES
POSITION OF CIRCUIT BREAKER	Bitarray2	R	*00 = disconnected* main and auxiliary contacts disconnected *01 = operational* auxiliary and main contacts connected *10 = test* auxiliary contacts connected, main contacts disconnected *11 = not present* breaker not present **Notes:** mechanical positions of the circuit breaker see chapter 2.3.2:
STATE OF CIRCUIT BREAKER	Bitarray2	R	*00 = Init (0)* *01 = Off (2)* *10 = On (1)* *11 = Tripped (3)* **Notes:** The number in brackets represents the position in Fig 4
READY TO SWITCH ON	Binary	R	*State:* *Ready TSO (5)*
UNDERVOLTAGE RELEASE	Binary	R	*Releases below a defined voltage limit* *Notes:* undervoltage release may not be available. Min/max voltage ranges defined in IEC 60947-2
SPRING LOADED	Binary	R	*one possible condition for state* *Ready TSO (5)*

OVERLOAD WARNING	Binary	R	A overload warning condition exists
			Notes:
			   - A overload warning condition is any condition above Ie which is abnormal but which does not require the immediate disconnection of the device(e.g. starter, circuit breaker) or the branch/feeder/load from the supply
			   - An overload warning condition may develop into a fault condition if remedial action is mot taken.
			   - No Overload Warning is the normal condition
			   - Tolerances defined within IEC 60947
			   - In some cases the rated current for the warning condition may differ from Ie.

ALARM	Binary	R	An alarm condition exists **Notes:** An alarm condition is any condition which is abnormal but which does not require the immediate disconnection of the device or the branch/feeder/load from the supply An alarm condition may develop into a fault condition if remedial action is not taken. No Alarm is the normal condition

NAME	Data type Units Offset Multiplier Range	Access	DEFINITION NOTES
POSITION OF CIRCUIT BREAKER	Bitarray2	R	*00 = disconnected*　　main and auxiliary contacts disconnected *01 = operational*　　auxiliary and main contacts connected 10 = test　　auxiliary contacts connected, main contacts disconnected *11 = not present*　　breaker not present **Notes:** mechanical positions of the circuit breaker see chapter 2.3.2:
STATE OF CIRCUIT BREAKER	Bitarray2	R	*00 = Init (0)* *01 = Off (2)* 10 = On (1) 11 = Tripped (3) **Notes:** The number in brackets represents the position in Fig 4
READY TO SWITCH ON	Binary	R	*State:* *Ready TSO (5)*
UNDERVOLTAGE RELEASE	Binary	R	*Releases below a defined voltage limit* *Notes:* undervoltage release may not be available. Min/max voltage ranges defined in IEC 60947-2
SPRING LOADED	Binary	R	*one possible condition for state* *Ready TSO (5)*
SETPOINT ACTIVATED	Binary	R	*parameterizable threshold value(s) exceeded* *Note:* warning indication for several setpoints, e.g. unbalances, voltage, current, etc.
WRITE PROTECTION ACTIVATED	Binary	R	Any write access will be denied, even signals like "Switch Off" via MS0. Write protection to be realized via hardware (e.g. soldered wire bridge).
INPUT N	Binary	R	Signal of a digital input N 0 = no current/signal on input N 1 = current/signal on input N

NAME	Data type Units Offset Multiplier Range	Access	DEFINITION NOTES
RELEASE REASON	Bitarray3	R	*000 = no release* *001 = L (ongtime) release* *010 = I (nstantaneous) release* *011 = S (horttime) release* *100 = earth fault* *101 = extended protection* *110 = over-current in N wire* **111 = no device information**
LOAD REJECTION	Binary	R	*(adjustable) current threshold value exceeded*
I_{Lmax}		R	max. line current
I_{L1}		R	Line current L1
I_{L2}		R	Line current L2
I_{L3}		R	Line current L3
I_N		R	*Current in N-line*
U_{LLavg}		R	*Average voltage line/line*
cos phi$_{avg}$		R	*Average of power factor*
E		R	*Active energy*
U_{L1-L2}		R	Voltage L1 – L2
U_{L2-L3}		R	Voltage L2 – L3
U_{L3-L1}		R	Voltage L3 – L1
U_{L1-N}		R	Voltage L1 – N
U_{L2-N}		R	Voltage L2 – N
U_{L3-N}		R	Voltage L3 – N
S_{total}		R	*Total apparent power*

Commands

Outputs from host controller to field device:

NAME	Data type Units Offset Multiplier Range	Access	DEFINITION NOTES
CIRCUIT BREAKER OPERATION	Bitarray2	R/W	*00 = no change* *01 = Off* **10 = On** *11 = no change* **Notes:** idle signal combinations are 00 or 11. On/Off signals are either limited by duration (min:....max:....) or by status information "reached target state". In case this state can not be reached within max time one of the idle signal combinations shall be set. Max duration: 500ms. Min duration: 200ms
CLEAR LAST TRIP	Binary	R/W	**Notes:** Clears the last trip indication of the circuit breaker.
OUTPUT N	Binary	R/W	Signal of a user definable output N **Notes:** 0=no current/signal on output N
TESTMODE	Bitarray2	R/W	*00= no test* *01 = w/o release* *10 = with release* **11 = test with warning**
DELETE HISTORY MEMORY	Binary	R/W	**Notes:** the history memory stores events with time stamps
RESET MIN/MAX MEMORY	Binary	R/W	**Notes:** this memory may store values of voltage, current, power
RESET TEMPERATURE MIN/MAX MEMORY	Binary	R/W	**Notes:** This memory stroes values of temperature
RESET MAINTENANCE INFO	Binary	R/W	**Notes:** deletes maintenance information within the device.
CLOCK SYNCHRONIZATION	Binary	R/W	**Notes:** this signal sets the internal clock of the device

Data Structures and Types

Monitoring (Inputs from device to host controller)

Monitoring information is always transported from the CB device (slave) to a host/controller.

This basic data structure is mandatory within any of the formats defined in the following chapters. It always uses the same position. The basic data structure consists of the state information.

The state information carries the most important binary status information about the circuit breaker across the BUS. Its Bits are counted consecutively, Bit 0 is Bit 0 in Byte 0, Bit 8 is Bit 0 in Byte 1. Unused Bits shall be set to 0.

State information

Byte	Bits: (0-7 for byte constructions; 0-15 for word constructions)							
	7	6	5	4	3	2	1	0
	15	14	13	12	11	10	9	8
0	OVERLOAD WARNING	SPRING LOADED (o)	UNDERVOLTAGE RELEASE	READY TO SWITCH ON (o)	STATE OF CIRCUIT BRAKER (m)		POSITION OF CIRCUIT BREAKER (o)	
1	LOAD REJECTION (o)	RELEASE REASON (m)			USER DEFINABLE INPUT (o)	WRITE PROTECTION ACTIVATED	WARNING (m)	SETPOINT ACTIVATED

mandatory	these bits shall be provided by all circuit breakers
optional	these bits may be provided. In case they are implemented they must have the same semantics.

Format 0

This basic format may be used by those circuit breaker devices which do not have measurement equipment on board or in cases the customer wants to optimize the performance of his BUS network.

Byte	0,1
Description	State

The position and the content of "Status" is identical through all formats and is described in chapter 0.

Format 1

Format 1 is designed for CBs that are able to measure triphase currents and to communicate them. This format offers less data size than format 2 and 3, i.e. better bus performance. In most of the cases this type represents the best compromise for CBs with current values but without further measurement features.

Byte	0,1	2,3	4,5	6,7	8,9
Description	State	I_{L1}	I_{L2}	I_{L3}	I_{Lmax}

I_{Lmax} represents the maximum value of the other three values I_{L1} to I_{L3}.

Format 2

Format 2 is built up on the structure of its predecessor like all the other types (upward compatibility). Thus this type is extended by four more measurement values that imply corresponding means to measure voltage, cos phi and active energy. This format is smaller than format 3 but offers a good compromise between fieldbus performance, the availability of load current values, and additional measurement information.

Byte	0, 1	2, 3	5, 6	6, 7	8, 9	10, 11	12, 13	14, 15	16, 17
Description	State	I_{L1}	I_{L2}	I_{L3}	I_{Lmax}	I_N	U_{LLavg}	cos phi$_{avg}$	E

Format 3

Format 3 transports 14 measurement values and has the least performance on the BUS. This format should be used whenever frequent updates of measurement values are needed for calculation or archiving.

Byte	0, 1	2, 3	5, 6	6, 7	8, 9	10, 11	12, 13	14, 15	16, 17
Description	State	I_{L1}	I_{L2}	I_{L3}	I_{Lmax}	I_N	U_{L1-L2}	U_{L2-L3}	U_{L3-L1}

Byte	18, 19	20, 21	22, 23	24, 25	26, 27	28, 29
Description	U_{L1-N}	U_{L2-N}	U_{L3-N}	cos phi$_{avg}$	E	S_{total}

Note: Type 3 is recommended for large circuit breakers only.

Command (Outputs from host controller to device)

Command information is always transported from a host/controller (master) to the CB device (slave).

The data structure from master to slave shall comply to the following format (m=mandatory). The Bit numbers are counted subsequently, Bit 0 is Bit 0 in Byte 0, Bit 8 is Bit 0 in Byte 1.

Format 0

Byte 0:

Bit	7	6	5	4	3	2	1	0
Des-cription	USER DEFINED OUTPUT 4	USER DEFINED OUTPUT 3	USER DEFINED OUTPUT 2	USER DEFINED OUTPUT 1	USER DEFINED OUTPUT 0	ACK OF LAST RELEASE (o)	CIRCUIT BREAKER (m)	

Byte1:

Bit	15	14	13	12	11	10	9	8
Description	CLOCK SYNCHRONIZATION	RESET MAINT INFO	USER DEFINED OUTPUT 5	RESET TEMPERATURE MIN/MAX MEMORY	RESET MIN/MAX MEMORY	DELETE HISTORY MEMORY	TEST MODE	

Profile

The profiles describe the supported combinations of the status- and command-formats.

Profile type	Monitoring format	Command format
1	0	0
2	1	0
3	2	0
4	3	0

Standardized Data

Basic Data Types

This profile provides four basic data formats (structures) that are attuned to each other. Every device shall support at least one of these basic data formats. It may support more or all of them.

The size of the data structures from slave to master depends on the type of basic data format and may comprise 2, 10, 18, or 30 bytes. The data format may be extended by device specific data (manufacturer option).

The basic data types used in any of the data formats are defined according to the PROFIBUS-Standard ("Motorola-Format" = big endian).

Integer16 An Integer16 is representing a signed number depicted by 16 bits.

Code	Data Type	Range	Resolution	Length
3	Integer16	$-32768 \leq i \leq 32767$	1	2 Bytes

In two's complement; the most significant bit (MSB) is the bit after the sign (SN) in the first Byte.
SN = 0: positive numbers and zero
SN = 1: negative numbers

Bit	7	6	5	4	3	2	1	0
Byte 1	SN	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8
Byte 2	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Unsigned8 An Unsigned8 is representing an unsigned number depicted by 8 bits

Code	Data Type	Range	Resolution	Length
5	Unsigned8	$0 \leq i \leq 255$	1	1 Bytes

Bit	7	6	5	4	3	2	1	0
Byte 1	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Unsigned16 An Unsigned16 is representing an unsigned number depicted by 16 bits.

Code	Data Type	Range	Resolution	Length

| 6 | Unsigned16 | $0 \leq i \leq 65535$ | 1 | 2 Bytes |

Bit	7	6	5	4	3	2	1	0
Byte 1	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8
Byte 2	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Visible String   This data type is defined as the ISO 646 string type. Characters are based on 8 Bit ASCII

Code	Data Type	Range	Resolution	Length
9	Visible String	refer to ISO 646	-	variable

Bit	7	6	5	4	3	2	1	0
Byte 1	1. Character							
Byte 2	2. Character							
...	.....							
...	.....							
Byte n	n. Character							

Quantities and Conversion

The measurement variables/parameters imply the following units with quantities. The variable "cos phi" is using the following scaling conversions:

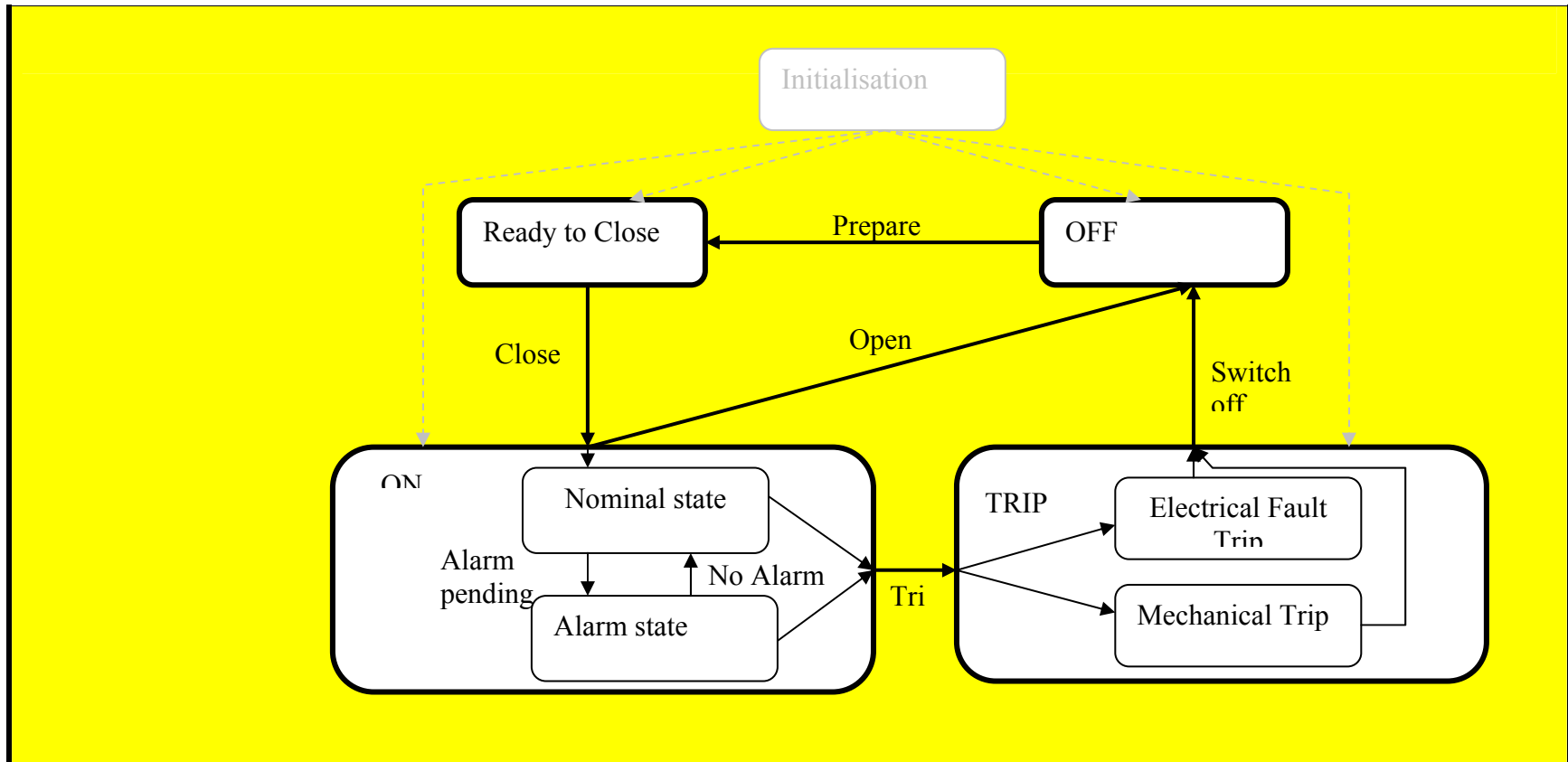|		
Cos Phi:	0 to –1000 for „-0" to „-1" (capacitive), 0 to 1000 for "0" to "1" (inductive)	**integer16**
Active Energy:	MWh	**integer16**
Effective Power:	kW	**integer16**
Apparent Power:	kVA	**unsigned16**
Current, Voltage:	A / V	**unsigned16**

Miscellaneous

Applicable Documents

[1]   *IEC TS 61915 2003-03, Low-voltage switchgear and controlgear – Principles for the development of device profiles for networked industrial devices*

[2]   *IEC 61158:2001, Digital data communications for measurement and control - Fieldbus for use in industrial control systems- Part 1-7: Layer specifications and service definitions*

[3]   *IEC 61784:2001, Digital data communications for measurement and control - Fieldbus for use in industrial control systems- Communication Profiles*

[4]   *IEC 60947-1 2001-12, Low voltage switchgear and controlgear- Part 1 General Rules*

[5]   *IEC 60947-2 2003-01, Low voltage switchgear and controlgear- Part 2 Circuit breakers*

[6]   *IEC 60947-4-1 2000-11, Low voltage switchgear and controlgear- Part 4-1 Contactors and starters*

[7]   *Switching, Protection and Distribution in Low-Voltage Networks –Handbook with selection criteria and planning guidelines for switchgear, switchboards and distribution systems (English edition of "Schalten, Schützen, Verteilen in Niederspannungsnetzen") 2nd edition, 1994, ISBN 3-89578-0006*

ROOT DEVICE PROFILE HEADER		
Root device profile ID:	Root device profile version:	Root device profile release date:
Device description: LOW VOLTAGE CIRCUIT BREAKER		

PALERMO (04)

Circuit Breaker Device Behaviour

DEVICE BEHAVIOUR (ROOT DEVICE PROFILE)
STATE MODEL (ROOT DEVICE PROFILE)
STATECHART DIAGRAM

Circuit Breaker State

Parameters list

PARAMETERS (ROOT DEVICE PROFILE) :							STATUS

Parameter name	Data type	Units	Offset	Multiplier	Range	Access	Required	Parameter description
CIRCUIT BREAKER STATE	Binary array [3]	x	x	x	x	R	M	Circuit Breaker state : 000 = OFF : The main circuit contacts are open 001 = ON : The main circuit contacts are closed Trip states : 010 = "Mechanical" Trip : MCCB mechanism unlatched 100 = Electrical fault Trip : Trip unit tripped Notes : 1. The circuit breaker is in the Trip State if any of the sub-states Mechanical or Electrical Fault trip is reached. 2. "Mechanical" Trip : only for MCCBs ; this state is achieved through shunt trip, UVR, interlock, push-to trip button,…

READY TO CLOSE	Binary	x	x	x	x	R	O	All the conditions that will permit the close operation of a circuit breaker by the remote host controller have been fulfilled.
								0 = NOT READY
								1 = READY TO CLOSE
								
								Notes:
								1. The manufacturer of the circuit breaker shall determine all the conditions that have to be fulfilled.
								2. Examples of the conditions which have to be fulfilled may include :
								      • Spring Loaded
								      • Remote operation selected
								      • Resetting of trips
								      • Etc.
								NOT READY is the inverse of READY TO CLOSE.

SPRING LOADED	Binary	x	x	x	x	R	O	Spring state : 0 = NOT LOADED 1 = LOADED
CIRCUIT BREAKER POSITION	Binary array [3]	x	x	x	x	R	O	Circuit Breaker position : 000 = Not present 001 = Disconnected 010 = Connected 100 = Test

| RELEASE CAUSE | Binary array [9] | x | x | x | x | R | M | The release cause of the last trip.

0x01: no release
0x01: long-time protection.
0x02: short-time protection
0x04: instantaneous protection
0x08: ground-fault protection
0x10: earth-leakage protection
0x20: self-protection (electrodynamic withstand)
0x40: self-protection (temperature)
0x80: self-protection (over-voltage)
0x100: extended cause
Reserved codes for extended trips :   0x200 to 0xFFFF |

Assemblies list

Parameter assembly name: **Circuit Breaker State**			Access: R				

Bit	7	6	5	4	3	2	1	0
Word	15	14	13	12	11	10	9	8
Byte 0	*Reserved*	*Reserved*	READY TO CLOSE	*Reserved*	SPRING LOADED	CIRCUIT BREAKER STATE		
Byte 1	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	CIRCUIT BREAKER POSITION		

Parameter assembly name: **Release Cause**			Access: R				

Bit	7	6	5	4	3	2	1	0
Word	15	14	13	12	11	10	9	8
Byte 2	RELEASE CAUSE							
Byte 3	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	RELEASE CAUSE

Notes :

1. The mandatory and the optional information displayed using the following colour code :

    MANDATOR

    OPTIONAL

    •   Mandatory informations :

    •   Optional informations :

2. The reserved bits are available for future profile evolutions.

Circuit Breaker Measurements

Parameters list

PARAMETERS (ROOT DEVICE PROFILE) :   MEASUREMENTS

Parameter name	Data type	Units	Offset	Multiplier	Range	Access	Required	Parameter description
I1 **(LINE CURRENT 1**	UNIT	A	0	1	0->32767	R	O	The average instantaneous value of current present in the specific phase conductor.
I2 **(LINE CURRENT 2**	UNIT	A	0	1	0->32767	R	O	The average instantaneous value of current present in the specific phase conductor.
I3 **(LINE CURRENT 3**	UNIT	A	0	1	0->32767	R	O	The average instantaneous value of current present in the specific phase conductor.
IN **(NEUTRAL LINE** **CURRENT)**	UNIT	A	0	1	0->32767	R	O	The average instantaneous value of current present in the N conductor.
I MAX **(MAX CURRENT)**	UNIT	A	0	1	0->32767	R	O	Maximum average instantaneous value of current of I1, I2, I3 and IN

Assemblies list

The measurement assemblies are manufacturer specific and could be described in the manufacturer profile.

Circuit Breaker Control

Parameters list

PARAMETERS (ROOT DEVICE PROFILE) :   CONTROL

Parameter name	Data type	Units	Offset	Multiplier	Range	Access	Required	Parameter description
CIRCUIT BREAKER ACTUATION	Binary array [3]					W	M	Instructs the circuit breaker to perform the following commands 010 = Open (switch on) 100 = Close (switch off) *Other values are reserved for profile extension purpose*

Assemblies list

Parameter assembly name: **Control (Output)**				Access: W				
Bit	7	6	5	4	3	2	1	0
Byte 0	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	CIRCUIT BREAKER ACTUATION		

Notes :

1. The mandatory and the optional informations are displayed using the following colour code :

    - Mandatory informations : MANDATOR

    - Optional informations : OPTIONAL

Circuit Breaker Parameter groups

The parameter groups are manufacturer specifics and could be described in the manufacturer profile.

Examples (part of the manufacturer profile subpart) :

PARAMETER GROUPS (ROOT DEVICE PROFILE)

Group name	Type	Number of members	Description	Additional information
Basic Monitoring	Status and measurement parameters	10	Signals describing the present state of the circuit breaker.	
Member names				
CIRCUIT BREAKER STATE				
RELEASE CAUSE				
Group name	Type	Number of members	Description	Additional information
Regular Monitoring	Status and measurement parameters	10	Signals describing the present state of the circuit breaker and its main measurements.	
Member names				
CIRCUIT BREAKER STATE				
RELEASE CAUSE				
I1				
I2				
I 3				
I N				
I Max				
Group name	Type	Number of members	Description	Additional information
Basic Control	Control parameters	1	Indications enabling the control of the circuit breaker	
Member names				
CIRCUIT BREAKER CONTROL				