

RELION® PROTECTION AND CONTROL

Protocol Implementation extra Information for Testing (PIXIT)

REX640 IEC 61850 interface



PRODUCT	PRODUCT CONNECTIVITY LEVEL	DOCUMENT ID.	REV.	LANG.	PAGE
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1. About this manual

1.1. Read it first!

Before attempting any operation with IED from REX640, read carefully the IED documentation first.

This document is addressed to anyone who needs to interact with REX640 and its IEC 61850 features in more detail.

1.2. Document information

Revision	Date	Note
A	13.4.2018	REX640 PCL1
B	14.11.2022	REX640 PCL4
C	29.10.2025	REX640 PCL5

Applicability

This manual is applicable to all REX640 Protection and Control IED versions mentioned in document Revision History above or newer versions if document update is not required.

1.3. Safety Information

There are safety warnings and notes in the following text. They are in a different format to distinguish them from normal text.

Safety warning

The safety warnings should always be observed. Non-observance can result in death, personal injury, or substantial damages to property. Guarantee claims might not be accepted when safety warnings are not respected. They look like below:



Do not make any changes to the REX640 configuration unless you are familiar with the REX640 and its configuration tool. This might result in disoperation and loss of warranty.

Note

A note contains additional information worth noting in the specific context, and looks like below:



The selection of this control mode requires caution, because operations are allowed both from the HMI and remotely.

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2. Abbreviations and Definitions

2.1. Abbreviations

Abbreviation	Description
ACSI	Abstract Communication Service Interface
FTP	File Transfer Protocol
GCB	Goose Control Block
GOOSE	Generic Object Oriented Substation Event
GSE	Generic Substation Event
HMI	Human Machine Interface
IED	Intelligent Electronic Device
LED	Light Emitting Diode
MAC	Media Access Control
MICS	Model Implementation Conformance Statement
MMS	Manufacturing Message Specification
M/O	Mandatory/Optional
GOOSE	Generic Object Oriented Substation Event
GSE	Generic Substation Event
HMI	Human Machine Interface
IED	Intelligent Electronic Device
LED	Light Emitting Diode
MAC	Media Access Control
MICS	Model Implementation Conformance Statement
MMS	Manufacturing Message Specification
M/O	Mandatory/Optional
N	No
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
RCB	Report Control Block
SCADA	Supervision, Control and Data Acquisition
Y	Yes

2.2. Definitions

Abbreviation	Description
Operational State	The unit is active and it is protecting and controlling the switchgear.
Stand-alone	The unit is not connected to a SCADA system.

3. Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in REX640.

Together with the PICS and the MICS the PIXIT forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information, which is not available in the PICS, MICS, TICS document or SCL file.

Each chapter specifies the PIXIT for each applicable ACSI service model as structured in IEC 61850-10. The “Ed” column indicates if the entry is applicable for IEC 61850 Edition 1 and/or Edition 2.

4. PIXIT for Documentation

Table 1 PIXIT for Documentation

ID	Ed	Description	Value/Clarification
Do1	2	How to expose required firmware versions not present in the datamodel	All required information present in data model. HMI page device information contains same information as well.

5. PIXIT for Configuration

Table 2 PIXIT for Configuration

ID	Ed	Description	Value/Clarification
Cf1	2	Can IED tool export ICD file or IID file (SICS I12)	ICD: Y IID: Y

6. PIXIT for Association Model

Table 3 PIXIT for Association Model

ID	Ed	Description	Value/Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	5
As2	1,2	TCP_KEEPALIVE value.	15 s
As3	1,2	Lost connection detection time range.	40 s

ID	Ed	Description	Value/Clarification
As4	1,2	Is authentication supported	Y
As5	1,2	What association parameters are necessary for successful association	Y Transport selector Y Session selector Y Presentation selector N AP Title N AE Qualifier
As6	1,2	Association parameters	Transport selector 0001 Session selector 0001 Presentation selector 00000001
As7	1,2	What is the maximum and minimum MMS PDU size	Max MMS PDU size: 32000 bytes Min MMS PDU size: 64 bytes Recommended Min MMS PDU size for reporting is >1000 bytes.
As8	1,2	What is the maximum start up time after a power supply interrupt	Between 10s-20s for the vertical communication, exact value depends on application size. Horizontal communication (GOOSE) starts within 3s if configuration remains the same.
As9	1,2	Does this device function only as a test equipment?	N

7. PIXIT for Server Model

Table 4 PIXIT for Server Model

ID	Ed	Description	Value/Clarification
Sr1	1,2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable Detail Quality: N Overflow Y OutofRange N BadReference N Oscillatory Y Failure N OldData N Inconsistent N Inaccurate Miscellaneous: Y Source Y Process N Substituted Y Test N OperatorBlocked
Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable Detail Quality: N BadReference Y Oscillatory Y Failure N OldData N Inconsistent N Inaccurate Miscellaneous: Y Source Y Process N Substituted Y Test N OperatorBlocked
Sr3	1,2	What is the maximum number of data values in one GetDataValues request	MMS stack does not limit the amount of the data values. MMS PDU is the limit.
Sr4	1,2	What is the maximum number of data values in one SetDataValues request	MMS stack does not limit the amount of the data values. MMS PDU is the limit.

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ID	Ed	Description	Value/Clarification
Sr5	1,2	Which Mode / Behaviour values are supported	On Y
			Blocked Y
			Test Y
			Test/Blocked Y
			Off Y
Sr6	1,2	Quality attribute use cases	INVALID + OSCILLATORY: - Binary input failure, e.g. oscillating input
			TEST: - When data or quality change occurs under test mode
			QUESTIONABLE + OLDDATA: - Default when data not updated or not used by configuration
			QUESTIONABLE + OUTOFRANGE: - According the limit supervision of the measurement blocks
			FAILURE + INVALID: - Device data in internal relay fault

8. PIXIT for Data Set Model

Table 5 PIXIT for Data Set Model

ID	Ed	Description	Value/Clarification
Ds1	1,2	What is the maximum number of data elements in one data set	80
Ds2	1,2	How many persistent data sets can be created by one or more clients	27
Ds3	1,2	How many non-persistent data sets can be created by one or more clients	Not supported service
Ds4	1,2	Additional limits	- 8 dataset for GOOSE - Overall 120 FCD/FCDAs for GOOSE - Ed.2: One dataset can contain maximum of 300 data attributes Ed.1: One dataset can contain maximum of 256 data attributes

9. PIXIT for Setting Group Control Model

Table 7 PIXIT for Setting Group Control Model

ID	Ed	Description	Value/Clarification
Sg1	1,2	What is the number of supported setting groups for each logical device?	Setting Group Control Block (SGCB) resides always in LD0.LLN0 and number of setting groups is 6.
Sg2	1,2	What is the effect of when and how the non-volatile storage is updated? (compare IEC 61850-8-1 §16.2.4)	Configuration resides in non-volatile memory. It is used when IED is restarted and configuration is changed. Changed settings are stored when settings editing is confirmed. Active setting group change will also be stored. Storing will take some time to complete and is typically between 1-20s. CnfEdit attribute will go back to FALSE after storing is complete.
Sg3	1,2	Can multiple clients edit the same setting group?	N
Sg4	1,2	Multiple clients activating setting group editing	If Client1 has activated setting group editing Client2 sees EditSG with value 0. If Client2 tries also to activate setting group editing Request results to Response-.
Sg5	1,2	What happens if the association is lost while editing a setting group?	When client has activated editing setting groups by writing a valid value to EditSG attribute in SGCB the setting group editing is only active the when connection between client and server is active. If association is lost setting group editing is cancelled by server.
Sg6	1,2	Is EditSG value 0 allowed?	Y
Sg7	2	When ResvTms is not present how long is an edit setting group locked	60 minutes
Sg8	1,2	Canceling of setting group editing	Canceling of setting group editing is done by writing value FALSE to CnfEdit attribute in SGCB.
Sg9	1,2	Changing active setting group	When changing the active setting group the CnfEdit is automatically set to TRUE. After storing is complete, the CnfEdit value is automatically set back to FALSE
Sg10	1,2	Timeout for setting group editing	60 minutes

10. PIXIT for Reporting Model

Table 8 PIXIT for Reporting Model

ID	Ed	Description	Value/Clarification
Rp1	1,2	The supported trigger conditions are	Integrity Y
			Data change Y
			Quality change Y
			Data update Y
			General interrogation Y
Rp2	1,2	The supported optional fields are	Sequence-number Y
			Report-time-stamp Y
			Reason-for-inclusion Y
			Data-set-name Y
			Data-reference Y
			Buffer-overflow Y
			EntryID Y
			Conf-rev Y
Segmentation Y			
Rp3	1,2	Can the server send segmented reports?	Y, typically 500 bytes is used for segmented report test.
Rp4	1,2	Mechanism on second internal data change notification of the same analogue data value within buffer period	Send report immediately
Rp5	1,2	Multi-client URCB approach	URCBs are visible and shared by all Clients.
Rp6	1,2	What is the format of EntryID	Octet string 8, four MSB bytes are used as counter.
Rp7	1,2	What is the buffer size for each BRCB or how many reports can be buffered	25 events buffer for each BRCB instance.
Rp8	1,2	Pre-configured RCB attributes that cannot be changed online	<data set name> <configuration revision>
Rp9	1,2	May the reported data set contain:	Y
		- structured data objects? - data attributes?	Y
Rp10	1,2	What is the scan cycle for binary events?	2 ms - 2.5 ms. Not configurable.
Rp11	1,2	Does the device support to pre-assign a RCB to a specific client in the SCL	Y, Behavior according to Rp13

ID	Ed	Description	Value/Clarification
Rp12	1,2	After restart of the server, is the value of ConfRev restored from the original configuration or retained prior to restart?	Retained prior to restart.
Rp13	2	Does the server accept any client to configure/enable a BRCB with ResvTms=-1?	Any client can configure and enable pre-configured report control block instance. Once report control has been reserved by a client, following configuration attempts must come from same IP address after client disconnect. If IP address does not match to client which made the reservation, any attempt to configure or enable report are blocked until reservation has expired or client with matching IP unreserved the report control block.
Rp14	1,2	Report time stamps	Most of the data object time stamps are defaulted in the startup. Timestamp is the time when IED gets the time synchronization first time during start-up. If time synchronization is not received a default time value is used with time invalid flag set. Time stamp value is updated when first real event occurs in the application.
Rp15	1,2	Is data model db=0 supported?	N
Rp16	1,2	What is the integrity period minimum value?	1000 ms. If client tries to set integrity period smaller than 1000 ms, period of one second is used and Response+ is sent to client.

11. PIXIT for GOOSE publish model

Table 10 PIXIT for GOOSE publish model

ID	Ed	Description	Value/Clarification
Gp1	1	Can the test flag in the published GOOSE be turned on/off?	Yes, by switching the test mode.
Gp2	1,2	What is the behavior when the GOOSE publish configuration is incorrect.	Incorrect configuration is detected by ICT and configuration is not possible to be written to the device until it is fixed.
Gp3	1,2	Published Supported FCD elements in dataset	Exchanged data in GOOSE can be any type of data, functional constraint been either ST or MX.
Gp4	1,2	What is the maximum value of TAL?	60 seconds, configurable

ID	Ed	Description	Value/Clarification
Gp5	1,2	What is the fastest retransmission time?	2 ms, fixed.
		What is the minimum MinTime supported (GSE.MinTime)	N
		Is MinTime configurable by SCT	
Gp6	1,2	Can the GOOSE publish be turned on/off by using SetGoCB-Values(GoEna)	Y
Gp7	1,2	What is the initial GOOSE sqNum after restart	sqNum = 1
Gp8	1,2	May the GOOSE data set contain:	
		- structured data object(FCD)?	Y
		- timestamp data attributes?	Y
		- data attributes	Y
Gp9	1,2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports? Does the IED accept a configuration with a GOOSE control with empty data set or too large data set?	Incorrect or incomplete configuration is detected by ICT and configuration is not possible to be written to the device until it is fixed.
Gp10	1,2	What is the minimum MaxTime supported (GSE.MaxTime)	1000 ms
Gp11	1,2	Amount of GOOSE datasets and dataset limits.	8 datasets can be used for GOOSE with limitation of 20 FCD/FCDA in each dataset and 120 FCD/FCDA overall. One dataset can contain more than 20 FCD/FCDA if overall limit is not exceeded when less than 6 datasets are used.

12. PIXIT for GOOSE subscribe model

Table 11 PIXIT for GOOSE subscribe model

ID	Ed	Description	Value/Clarification
Gs1	1,2	What elements of a subscribed GOOSE message are checked to decide the message is valid and the allData values are accepted?	Y destination MAC address
			Y Ethertype = 0x88B8
			N gocbRef
			N timeAllowedtoLive
			N datSet
			N goID
			N t
			Y stNum
			Y sqNum
			Y simulation / test
			Y confRev
Y ndsCom			
Y numDatSetEntries			
Y APPID			
Gs2	1,2	When is a subscribed GOOSE marked as lost? (TAL = time allowed to live value from the last received GOOSE message)	Message does not arrive in 2 x TAL + 30 ms. When TAL = 0, GOOSE is marked lost after 2 x 1000 ms + 30 ms
Gs3	1,2	What is the behavior when one subscribed GOOSE message isn't received or syntactically incorrect	Syntactically incorrect: A separate error counter is increased, subscribed dataset is defaulted and a warning is activated. Alarm event is also generated for client application. Message loss: Behaviour is the same as above if more than one message is lost. One message loss only increments error counter.
Gs4	1,2	What is the behavior when a subscribed GOOSE message is out-of-order?	A separate error counter is increased, subscribed dataset is defaulted and a warning is activated. Alarm event is also generated for client application. Message is not processed further. If frames are in wrong order(e.g. sqNum= 1,0,3,2), and stNum does not change, only first frame is processed and other frames are ignored.
Gs5	1,2	What is the behavior when a subscribed GOOSE message is duplicated?	Message with same stNum is not processed further.
Gs6	1,2	Does the device subscribe to GOOSE messages with/without the VLAN tag?	Y, with the tag. Y, without the tag.

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ID	Ed	Description	Value/Clarification
Gs7	1,2	May the GOOSE data set contain: structured data object(FCD)? timestamp data attributes?	Y Y
Gs8	1,2	Supported FCD/FCDA elements in dataset	Exchanged data in GOOSE can be any type of data, functional constraint been either ST(FCD/FCDA) or MX(FCD/FCDA).
Gs9	1,2	Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted?	Ed1: Only processed if IED is in Test state. Ed2: Frame is accepted if simulation allowance is set to TRUE, otherwise frame is rejected
Gs10	1,2	Max number of dataset members	1000
Gs11	1,2	Is fixed-length encoded GOOSE supported?	Y
Gs12	Amd1	Is the "processing data as invalid" configurable? When not configurable how does the subscriber "process data as invalid"?	N Keep last non test value YN Substitute to a configured value Y Set derived quality to invalid: Y
Gs13	1,2	Messages with Needs Commissioning bit set.	A separate error counter is increased, subscribed dataset is defaulted and a warning is activated. Alarm event is also generated for client application.
Gs14	1,2	Messages with wrong ConfRev.	A separate error counter is increased, subscribed dataset is defaulted and a warning is activated. Alarm event is also generated for client application.
Gs15	1,2	What is the behavior when subscribed dataset has quality attribute(s)?	GOOSE Input is set to defaulted state when the received quality attribute differs from GOOD. Default value is always false (0). Quality propagates to application. Received bad quality defaults the input value and in application logic the value is treated as false (0), regardless of the original status value.
Gs16	1,2	GOOSE Alarm	If any of the subscribed GOOSE data is in timeout an alarm is activated in LDO.GSELPRT1.Alm. In this case Data Object gets value TRUE.

13. PIXIT for IEC 61869-9 publisher

Table 12 PIXIT for IEC 61869-9 publisher

ID	Description	Value/Clarification
Svp1	Supported application class	Protective and measuring
Svp2	Support behaviour = test	Y
	Support behaviour = off	Y
Svp3	Support simulation mode	
	Backwards rates	N
	Preferred rates	N
	When supported how to enable simulation mode	
Svp4	Are neutral sampled values calculated	Configurable
Svp5	How are the CT/VT ratios configured.	By setting following parameters via HMI: CT: - Parameterization/Configuration/Analog inputs /Current(3I)/Primary Current - Parameterization/Configuration/Analog inputs /Current(3I)/Secondary Current VT: - Parameterization/Configuration/Analog inputs /Voltage(3U)/Primary Voltage - Parameterization/Configuration/Analog inputs /Voltage(3U)/Secondary Voltage
Svp6	Support time synchronization method	Y PTP
		N PPS
Svp7	What is the maximum time required to achieve synchronization after restoring the time synch	60 seconds
Svp8	What is the maximum time required to achieve synchronization after power up	60 seconds
Svp9	In which conditions is the quality field Validity set to Invalid	9-2LE SV MU01: unused channels, Int32 overflow 61869-9 SV MU02: never
Svp10	What is the maximum time to start-up the device	40 seconds

ID	Description	Value/Clarification
Svp11	How can the date of manufacture be derived from PhyNam.serNum?	Device manufacture date can be derived by serial number by contacting ABB support and providing device serial number and asking manufacture date for that. Alternatively in HMI the production date is available: Information\Product identifiers\Production date IEC61850: LD0.LDEV1.OrdNum.t
Svp12	Calculated IN	N/A
Svp13	Is detail quality “out-of-range” supported? How to force out-of-range?	9-2LE MU01: no IEC 61869-9 MU03: yes, when exceeding the channel clipping limit
Svp14	Maximum number of channels by rate	Backwards-compatible/Legacy rates: F4000S1: 1 F4800S1: 1 F5760S1: 0 F12800S8: 0 F15360S8: 0 Preferred rates: F4800S2: 1 F14400S6: 0 F96000S1: 0

14. PIXIT FOR IEC 61869-9 subscriber

Table 13 PIXIT for IEC 61869-9 subscriber

ID	Description	Value/Clarification
Svs1a	How does the subscriber process subscribed sampled values (one is mandatory)	TxTR Y MMXU Y MMTR Y Web interface Y Display Y
Svs1b	How does the subscriber supervise subscribed sampled values	LSVS Y LCCH Y Web interface Y Display Y

ID	Description	Value/Clarification
Svs2a	Which backwards compatible variants can be subscribed to	F4000S1I4U4 Y F4800S1I4U4 Y
Svs2b	Which preferred variants can be subscribed to	F4800S2IxUy Y Supported values for x 12 Supported values for y 12 Maximum value for x+y 24
asSvs3	Support simulation mode - Preferred rates - Backwards compatible rates How to enable simulation mode	Y Y LPHD.Sim
Svs4	Which element of the SV header are verified	MAC-address Y APPID Y SVID Y ConfRev > Y ConfRev < Y
Svs5	What will happen in case an extra element pair is added to the data set What will happen in case an element pair of the data set is missing	Message with a missing pair is ignored Message with an extra element pair is ignored
Svs6	How does the subscriber behave in case a broken path is detected	LSVS TxTR Web interface Display LSVS.St will be set to FALSE TxTR's ALARM and WARNING signals will be activated Subscribed stream's signals will be marked as "receive-timeout" Subscribed stream's signals will be marked as "receive-timeout" (See the testing and commissioning menu)

ID	Description	Value/Clarification
Svs7	How does the subscriber behave in case packets are missing - 1 packet - 3 consecutive packets - 5 consecutive packets - 10 consecutive packets - Packet with smpCnt = 0	The relay can withstand 1 packet loss (two consecutive samples) In any other case, the relay will considered the the incoming samples have timeout and it will set both TxTR ALARM and WARNING signals. There is no specific packet handling error when the smpCnt zero is missing.
Svs8	How does the subscriber behave in case - smpSynch = 0 - smpSynch = 2 - smpSynch = 1, 3..255	LSVS LSVS.TmGlobSynOk = FALSE and LSVS.TmGenSynOk = FALSE LSVS.TmGlobSynOk = TRUE and LSVS.TmGenSynOk = TRUE LSVS.TmGlobSynOk = FALSE and LSVS.TmGenSynOk = TRUE
Svs9	How does the subscriber behave in case - one sample value continuously has quality invalid - all sample values continuously have quality invalid	For both cases: The corresponding application data will have quality invalid. The connected TxTR blocks' ALARM signals will be set to TRUE
Svs10	Declare smallest value of publisher maximum processing delay time that the subscriber requires	2 ms

ID	Description	Value/Clarification																																			
Svs11	What is the total delay that can be tolerated	Svs10 value plus Max Delay settings:																																			
		<table border="1"> <thead> <tr> <th>SMV max delay enum setting</th> <th colspan="4">Protection delay (ms)</th> </tr> <tr> <th></th> <th>9-2LE 50 Hz</th> <th>61869-9 50 Hz</th> <th>9-2LE 60 Hz</th> <th>61869-9 60 Hz</th> </tr> </thead> <tbody> <tr> <td>miniumum</td> <td>0,31</td> <td>0,31</td> <td>0,35</td> <td>0,52</td> </tr> <tr> <td>low</td> <td>1,35</td> <td>1,56</td> <td>1,39</td> <td>1,56</td> </tr> <tr> <td>medium</td> <td>2,40</td> <td>2,81</td> <td>2,43</td> <td>2,60</td> </tr> <tr> <td>high</td> <td>3,44</td> <td>4,06</td> <td>3,47</td> <td>3,65</td> </tr> <tr> <td>maximum</td> <td>4,48</td> <td>5,31</td> <td>4,51</td> <td>4,69</td> </tr> </tbody> </table>	SMV max delay enum setting	Protection delay (ms)					9-2LE 50 Hz	61869-9 50 Hz	9-2LE 60 Hz	61869-9 60 Hz	miniumum	0,31	0,31	0,35	0,52	low	1,35	1,56	1,39	1,56	medium	2,40	2,81	2,43	2,60	high	3,44	4,06	3,47	3,65	maximum	4,48	5,31	4,51	4,69
		SMV max delay enum setting	Protection delay (ms)																																		
			9-2LE 50 Hz	61869-9 50 Hz	9-2LE 60 Hz	61869-9 60 Hz																															
		miniumum	0,31	0,31	0,35	0,52																															
		low	1,35	1,56	1,39	1,56																															
		medium	2,40	2,81	2,43	2,60																															
high	3,44	4,06	3,47	3,65																																	
maximum	4,48	5,31	4,51	4,69																																	
Svs12	Which function can be used to verify the polarity of subscribed samples IN?	Polarity can be checked from the phase angles provided by the MMXU functions																																			

15. PIXIT for GOOSE performance

Table 14 PIXIT for GOOSE performance

ID	Ed	Description	Value/Clarification
Gf1	1,2	Performance class	P1
Gf2	1,2	GOOSE ping-pong processing method	Scan cycle based
Gf3	1,2	Application logic scan cycle (ms)	Min. 2,08 ms Max. 2,5 ms
Gf4	1,2	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	20
Gf5	1,2	Overall maximum number of data attributes on GOOSE datasets.	120 attributes
Gf6	1,2	Maximum number of subscribed GOOSE datasets	50

16. PIXIT for Control Model

Table 15 PIXIT for Control Model

ID	Ed	Description	Value/Clarification
Ct1	1,2	What control modes are supported	Y Status-only Y Direct-with-normal-security N Sbo-with-normal-security N Direct-with-enhanced-security Y Sbo-with-enhanced-security
Ct2	1,2	Is the control model fixed, configurable and/or online changeable?	CTRL.CBCSWI object is configurable. All other objects are fixed.
Ct3	1,2	Is Time activated operate (operTm) supported	N
Ct4	1,2	Is “operate-many” supported	N
Ct5	1	Will the DUT activate the control output when the test attribute is set in the SelectWithValue and/or Operate request (when N test procedure Ctl2 is applicable)	Y
Ct5	1,2	What is the behavior when the test attribute is set in the SelectWithValue and/or Operate request	If IED is in Test mode, control operation is accepted. Otherwise server responds as follows: DOs: Response- is returned SBOes: Response- is returned with additional cause “Select Failed”
Ct6	1,2	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	Not used by application
Ct7	1,2	Is pulse configuration supported	Y
Ct8	1,2	What is the behaviour of the DUT when the check conditions are not set	IED refuses to bypass the check with addCause “Blocked-by-interlocking” when controllable object is interlocked. Otherwise, command will proceed with additional checks. Fixed

ID	Ed	Description	Value/Clarification
Ct8	1,2	What check conditions are supported?	N Synchrocheck N Interlock-check IED ignores the check value and always performs the check.
		Is this behaviour fixed, configurable, online changeable?	Fixed.
Ct9	1,2	What service error types are supported?	N Instance-not-available N Instance-in-use Y Access-violation N Access-not-allowed-in-current-state N Parameter-value-inappropriate N Parameter-value-inconsistent N Class-not-supported N Instance-locked-by-other-client N Control-must-be-selected Y Type-conflict N Failed-due-to-communications N Constraint failed-due-to-server-constraint
Ct10	1,2	What additional cause diagnosis are supported?	N Unknown Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached Y Parameter-change-in-execution N Step-limit Y Blocked-by-Mode N Blocked-by-process Y Blocked-by-interlocking N Blocked-by-synchrocheck Y Command-already-in-execution Y Blocked-by-health Y 1-of-n-control Y Abortion-by-cancel Y Time-limit-over N Abortion-by-trip Y Object-not-selected Edition 2 specific values: Y Object-already-selected N No-access-authority N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss N Blocked-by-command N None Y Inconsistent-parameters Y Locked-by-other-client

ID	Ed	Description	Value/Clarification
Ct11	1,2	How to force a “test-not-ok” respond with SelectWithValue request?	By using orCat value which is out of range (e.g. 9).
Ct12	1,2	How to force a “test-not-ok” respond with Operate request?	By using orCat value which is out of range (e.g. 9). SBOes: By using different parameters in Select and Operate (e.g. Test).

ID	Ed	Description	Value/Clarification
Ct13	1,2	Which origin categories are supported?	<p>For primary apparatus control DPC and BSC (ATCC.TapChg) according “Station authority” setting (CTRL.LLN0.StaLevSet):</p> <p>“Station authority” 1 (L,R) and 3(L,R,L+R): Y not-supported Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process</p> <p>“Station authority” 2(L,S,R) and 4(L,S,S+R,L+S,L+S+R): N not-supported N bay-control Y station-control Y remote-control N automatic-bay N automatic-station N automatic-remote N maintenance N process</p> <p>For LLN0 Mod control INC according “Remote test mode” setting (LD0.LDEV1.ModRemCtl)</p> <p>“Remote test mode” 2(Maintenance): N not-supported N bay-control N station-control N remote-control N automatic-bay N automatic-station N automatic-remote Y maintenance N process</p> <p>“Remote test mode” 3 (All levels): Y not-supported Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process</p>

ID	Ed	Description	Value/Clarification
Ct14	1,2	What happens if the orCat value is not supported?	<p>DOns: Response- is returned</p> <p>SBOes: Response- is returned with additional cause blocked-by-switching hierarchy.</p> <p>Out of range orCat value will return response- with additional cause select-failed.</p>
Ct15	1,2	Does the IED accept a SelectWithValue/Operate with the same ctlVal as the current status value? Is behaviour configurable?	<p>DOns: Y</p> <p>SBOes: Y</p> <p>Operation for Open is always accepted. However operation for close will return response- with additional cause position-reached.</p> <p>DOns: N</p>
Ct16	1,2	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	<p>DOns: N</p> <p>SBOes: N</p>
Ct17	1,2	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (tissue 334)?	<p>SBOes: N</p>
Ct18	1,2	Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?	SelectWithValue and Operate
Ct19	1,2	Can a control operation be blocked by Mod=Off or Blocked?	Y
Ct20	1,2	Does the IED support local / remote operation?	Y
Ct21	1,2	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	<p>DOns N</p> <p>SBOes: N</p>

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ID	Ed	Description	Value/Clarification
Ct22	1,2	How to force a “parameter-change-in-execution”?	SBOes: By e.g., editing setting group between Select and Operate commands.
Ct23	1,2	How many SBOs/SBOes control objects can be selected at the same time?	1
Ct24	1,2	Can a controllable object be forced to keep its old state?	Y
Ct25	1,2	Is it possible to have DPC to the intermediate state?	Y
Ct26	1,2	Command timeout	Configurable data for both Select and Operate. Operation Timeout is at minimum 3s even when the set value is smaller. The selection is active configurable time, default is 30s. During this time the operate command should be given. When the operation is given additional configurable time is reserved for the command termination.
Ct27	1,2	Does the IED support control objects with external signals?	Y
Ct28	2,Amd1	Does the IED support XCBR/XSWI.Loc=False and LLN0/CSWI.Loc=True Does the IED accept the control with orCat=1 or 4 Local	Y N
Ct29		What is the Operate timeout?	configurable

17. PIXIT for Time and Time Synchronization Model

Table 16 PIXIT for Time and Time Synchronization Model

ID	Ed	Description	Value/Clarification	
Tm1	1,2	What quality bits are supported?	Y	LeapSecondsKnown N ClockFailure Y ClockNotSynchronized
Tm2	1,2	What is the behavior when the time synchronization signal/messages are lost?		Two SNTP Time Servers are supported. If primary server is not available, secondary server is taken into use. If both primary and secondary servers are not available, IED will go to unsynchronized state. For more behavior see Tm9.
Tm3	1,2	SNTP Request Interval		60 seconds
Tm4	1,2	Time tagging of events		Overall time synchronization accuracy is T1 for computed events.
Tm5	1,2	When is the time quality bit "Clock not synchronised" set?		After 3min timeout when SNTP server has not responded.
Tm6	1,2	Is the timestamp of a binary event adjusted to the scan cycle?	Y	
Tm7	1,2	Does the device support time zone and daylight saving?	Y	
Tm8	1,2	Which attributes of the SNTP response packet are validated?	Y Y Y Y Y	Leap indicator not equal to 3? Mode is equal to SERVER Originate Timestamp is equal to value sent by the SNTP client as Transmit Timestamp RX/TX timestamp fields are checked for reasonableness SNTP version 3 and/or 4

ID	Ed	Description	Value/Clarification
Tm9	1,2	SNTP Time synchronization behavior	<p>Startup: IED will read the absolute time and will set its internal clock accordingly.</p> <p>Looking for an SNTP server: During this phase no time data are produced.</p> <p>Synchronized to an SNTP server: The accurate SNTP algorithm is acquiring the data needed to reach full accuracy.</p> <p>The SNTP server in use is lost: Meaning one of the following: - It stops responding. - It sends a “kiss’o’d death” message. - It is not synchronized.</p> <p>SNTP disabled by Configuration: Other time synchronization mechanism is used.</p> <p>The SNTP server is in use and time shift is tested When time shift is detected (e.g. during conformance testing), at least two SNTP server responses are required to reach full accuracy.</p>
Tm10	1,2	SNTP Time quality behavior	When time change occurs(e.g. one hour jump in server), time quality will go first to zero and stabilizes to 10 bits after 2 to 5 SNTP requests.
Tm11	1,2	Do the COMTRADE files have local or UTC time and is this configurable?	UTC, not configurable.

18. PIXIT for File Transfer Model

Table 17 PIXIT for File Transfer Model

ID	Ed	Description	Value/Clarification
Ft1	1,2	What is structure of files and directories?	The Disturbance Recorder files are stored in COMTRADE directory. COMTRADE files are not zipped.
Ft2	1,2	Directory names are separated from the file name by	“\”
Ft3	1,2	The maximum file name size including path (recommended 64 chars)	256 characters.
Ft4	1,2	Are directory/file name case sensitive	N

ID	Ed	Description	Value/Clarification
Ft5	1,2	Is the wild card supported in MMS fileDirectory request?	Yes, wild card = *
Ft6	1,2	Directory listing	When client requests a directory contents the request must be following format; "COMTRADE", "COMTRADE\ ", or "COMTRADE*". Response listing has whole path(including file name).
Ft7	1,2	Maximum file size	Maximum file size is not defined. Free space varies and size depends on configuration. 'SetFile' is not supported.
Ft8	1,2	Is it allowed that 2 clients get the same file at the same time?	Y
Ft9	1,2	Which files can be deleted?	Disturbance record files in COMTRADE directory.

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