

Easergy MiCOM P445

Fast Multifunction Distance Protection Relay

P445/EN PX/G82

Software Version	J7
Hardware Suffix	L
IEC61850 Edition	2
Issue Date	08/2017

Protocol Implementation eXtra Information for Testing
(PIXIT)

Note

The technical manual for this device gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate Schneider Electric technical sales office and request the necessary information.

Any agreements, commitments, and legal relationships and any obligations on the part of Schneider Electric including settlements of warranties, result solely from the applicable purchase contract, which is not affected by the contents of the technical manual.

This device **MUST NOT** be modified. If any modification is made without the express permission of Schneider Electric, it will invalidate the warranty, and may render the product unsafe.

Easergy MiCOM and the Schneider Electric logo and any alternative version thereof are trademarks and service marks of Schneider Electric.

All trade names or trademarks mentioned herein whether registered or not, are the property of their owners.

This manual is provided for informational use only and is subject to change without notice.

© 2017, Schneider Electric. All rights reserved.

**PROTOCOL IMPLEMENTATION
EXTRA INFORMATION FOR
TESTING (PIXIT)**

Date (month/year):	08/2017
Products covered by this chapter:	This chapter covers the specific versions of the MiCOM products listed below. This includes only the following combinations of Software Version and Hardware Suffix.
Hardware suffix:	L
Software version:	J7
Connection diagrams:	This includes a list of the Connection Diagrams for the Products covered by this document. 10P445xx (xx = 01 to 04)

CONTENTS

	Page-
1 Introduction	5
2 Document Structure	6
3 PIXIT for Association Model	7
4 PIXIT for Server Model	8
5 PIXIT for Data Set Model	10
6 PIXIT for Substitution Model	11
7 PIXIT for Setting Group Control Model	12
8 PIXIT for Reporting Model	13
9 PIXIT for Logging Model	14
10 PIXIT for GOOSE Publish Model	15
11 PIXIT for GOOSE Subscribe Model	16
12 PIXIT for GOOSE Performance	18
13 PIXIT for Control Model	19
14 PIXIT for Time Synchronisation Model	22
15 PIXIT for File Transfer Model	23
16 PIXIT for Service Tracking Model	24

Notes:

1 INTRODUCTION

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC61850 interface in the MiCOM P445 with firmware version J7 of protection IEDs.

Together with the PICS and MICS specifications the PIXIT forms the basis for 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.

2 DOCUMENT STRUCTURE

Each table specifies the PIXIT for 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.

3 PIXIT FOR ASSOCIATION MODEL

ID	Ed	Description	Value / Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	16
As2	2	TCP_KEEPALIVE value The recommended range is 1..20s	Configurable between 1 and 20 second with a setting increment of 1 second. The default value is 5.
As3	2	Lost connection detection time	Lost connection time = TCP_KEEPALIVE + 30s
As4	-	Authentication is not supported yet	
As5	2	What association parameters are necessary for successful association	Transport selector Calling: N Called: Y Session selector Calling: N Called: Y Presentation selector Calling: N Called: Y AP Title Calling: N Called: N AE Qualifier Calling: N Called: N
As6	2	If association parameters are necessary for association, describe the correct values e.g.	Transport selector 0001 Session selector 0001 Presentation selector 00000001 AP Title na AE Qualifier na
As7	2	What is the maximum and minimum MMS PDU size	Max MMS PDU size 8000bytes Min MMS PDU size 500bytes
As8	2	What is the maximum startup time after a power supply interrupt	Full IEC61850 services are available after approximate start-up time of 150 seconds. For even big IEC61850 configuration file, time will extend 30 seconds.
As9	2	Does this device function only as test equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	No

4 PIXIT FOR SERVER MODEL

ID	Ed	Description	Value / Clarification
Sr1	2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable, (not testable) N Overflow N OutofRange N BadReference N Oscillatory Y Failure, (not testable) N OldData Y Inconsistent, (not testable) Y Inaccurate, (not testable) Source: Y Process N Substituted Y Test Y OperatorBlocked, (not testable)
Sr2	2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable, (Not testable) N BadReference N Oscillatory Y Failure, (Not testable) N OldData Y Inconsistent, (not testable) Y Inaccurate , (not testable) Source: Y Process N Substituted Y Test Y OperatorBlocked, (not testable)
Sr3	-	What is the maximum number of data object references in one GetDataValues request	Deprecated
Sr4	-	What is the maximum number of data object references in one SetDataValues request	Deprecated
Sr5	1	Which Mode values are supported ¹	On Y Implemented on all LN [On-]Blocked N Test Y Implemented on all LN Test/Blocked Y Only implemented on System\RlyGGIO1 Off Y Only implemented on the LN under LD – protection, except for Protection\LLNO

¹ IEC 61850-6:2009 clause 9.5.6 states that if only a sub range of the enumeration value set is supported, this shall be indicated within an ICD file by an enumeration type, where the unsupported values are missing

ID	Ed	Description	Value / Clarification
Sr_ex1	2	Measurement deadbands	<p>Each measurement provides a range configuration in the data model where a minimum and maximum value can be set. Then deadbands can be specified as a percentage change based on such a range</p> <p>For this reason, deadband also can be configured based on an absolute value change with the following ranges:</p> <ol style="list-style-type: none">1. deadband = 0, means deadband disabled and measurements follow the instantaneous measurement value.2. deadband = 1-100,000, means absolute value changes of 0.001 to 100 respectively based on the formula: $(\text{deadband}/100000) * (\text{max} - \text{min})$. Deadband measurement will be updated when the instantaneous (absolute) value changes by more than the absolute deadband value. <p>For complex measurement types supporting both magnitude and angle, the deadband will only apply to the magnitude element.</p>

5 PIXIT FOR DATA SET MODEL

ID	Ed	Description	Value / Clarification
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)	300
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	0
Ds3	1	How many non-persistent data sets can be created by one or more clients	0
Ds_ex1	2	The fixed location of pre-configured data sets.	System\LLN0
Ds_ex2	2	How many pre-configured data sets can be created by one or more clients	100
Ds_ex3	2	How many data attributes supported in all datasets totally?	4000

6 PIXIT FOR SUBSTITUTION MODEL

Not support

7 PIXIT FOR SETTING GROUP CONTROL MODEL

ID	Ed	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device (compare NumSG in the SGCB)	4
Sg2	2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 §16.2.4)	N/A, Edit SG is not supported
Sg3	1	Can multiple clients edit the same setting group	N/A, Edit SG is not supported
Sg4	1	What happens if the association is lost while editing a setting group	N/A, Edit SG is not supported
Sg5	1	Is EditSG value 0 allowed?	N/A, Edit SG is not supported.
Sg6	2	When ResvTms is not present how long is an edit setting group locked	N/A, Edit SG is not supported

8 PIXIT FOR REPORTING MODEL

ID	Ed	Description	Value / Clarification
Rp1	1	The supported trigger conditions are (compare PICS)	integrity Y data change Y quality change Y data update can be set but could not triggerd general interrogation Y
Rp2	1	The supported optional fields are	N/A
Rp3	2	Can the server send segmented reports (when not supported it is allowed to refuse an association with a smaller than minimum PDU size)	Y
Rp4	2	Mechanism on second internal data change notification of the same analogue data value within buffer period (Compare IEC 61850-7-2 §14.2.2.9)	Send report immediately
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2 §14.2.1)	Each URCB is visible to all clients
Rp6	-	What is the format of EntryID	Deprecated
Rp7	2	What is the buffer size for each BRCB or how many reports can be buffered	100k
Rp8	-	Pre-configured RCB attributes that are dynamic, compare SCL report settings	Deprecated
Rp9	1	May the reported data set contain: - structured data objects? - data attributes?	Y Y
Rp10	2	What is the scan cycle for binary events? Is this fixed, configurable	1 ms Fixed
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL	Y
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart.	Restored from original configuration
Rp_ex1	2	How many URCB and BRCB support	16 URCB and 8 instances for each URCB 8 BRCB and 4 instances for each BRCB

9 PIXIT FOR LOGGING MODEL

Not support.

10 PIXIT FOR GOOSE PUBLISH MODEL

ID	Ed	Description	Value / Clarification
Gp1	2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set	Y
Gp2	1	What is the behaviour when the GOOSE publish configuration is incorrect	NdsCom = T DUT keeps GoEna=F
Gp3	2	Published FCD supported common data classes are	ENC,ENS,MV,SPC,SPS, WYE,ACD,ACT
Gp4	2	What is the slow retransmission time Is it fixed or configurable	60s Configured by GoCB Maximum Cycle Time
Gp5	2	What is the fastest retransmission time Is it fixed or configurable	1ms Configured by GoCB Minimum Cycle Time
Gp6	-	Can the GOOSE publish be turned on / off by using SetGoCBValues(GoEna)	Deprecated See PICS - SetGoCBValues
Gp7	2	What is the initial GOOSE sqNum after restart	1
Gp8	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	Y Y
Gp9	2	Is the DUT a test equipment	N

11 PIXIT FOR GOOSE SUBSCRIBE MODEL

ID	Ed	Description	Value / Clarification
Gs1	2	<p>What elements of a subscribed GOOSE message are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions.</p> <p>Notes: the VLAN tag may be removed by a ethernet switch and shall not be checked the simulation flag shall always be checked (Ed2)</p>	<p>Y destination MAC address Y APPID N gocbRef Y timeAllowedtoLive Y datSet Y gold N t Y stNum N sqNum Y simulation Y confRev Y ndsCom Y numDatSetEntries</p> <p>(When the numDatSetEntries in a subscribed GOOSE message is equal to or more than DO index which IED want to subscribe, the IED shall accept and parse this kind of GOOSE message as normal.</p> <p>When the numDatSetEntries in a subscribed GOOSE message is less than DO index which IED want to subscribe, the IED shall ignore this kind of GOOSE message.)</p> <p>Y out-of-order dataset members (Type is checked)</p>
Gs2	2	<p>When is a subscribed GOOSE marked as lost (TAL = time allowed to live value from the last received GOOSE message)</p>	<p>Message does not arrive by (TAL + 1s)</p>
Gs3	2	<p>What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)</p>	<p>An alarm will be raised to indicate GOOSE IED absent. And the virtual inputs value will be forced to its configured default value.</p> <p>If under the following GOOSE message conditions, GOOSE absent alarm will not be generated</p> <p>- data type wrong configuration or disorder configuration</p>
Gs4	2	<p>What is the behavior when a subscribed GOOSE message is out-of-order</p>	<p>No checks are made for out-of-order GOOSE messages, they are validated in accordance with the rules given in Gs1.</p>
Gs5	2	<p>What is the behavior when a subscribed GOOSE message is duplicated</p>	<p>Receive this message as normal.</p>
Gs6	1	<p>Does the device subscribe to GOOSE messages with/without the VLAN tag?</p>	<p>Y, with or without the VLAN tag.</p>
Gs7	1	<p>May the GOOSE data set contain: - structured data objects (FCD)? - timestamp data attributes?</p>	<p>Subscribed Y Y</p>
Gs8	2	<p>Subscribed FCD supported common data classes are</p>	<p>ENC,ENS,SPC,SPS, ACD,ACT Analogue GOOSE support MV</p>
Gs9	2	<p>Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode</p>	<p>Y</p>

ID	Ed	Description	Value / Clarification
Gs_ex1	2	Default values	<p>The virtual inputs value will return to default value when TAL+1 expires on following GOOSE message conditions:</p> <ul style="list-style-type: none"> - The publishing device is absent (i.e. No GOOSE message are received) - goID is different from GoCB and NULL - numDatSetEntries is 0, more or less than the number of data entries in the all Data- all data elements mismatching order - APPID is different from SCL and 0 - datSet is different from GoCB and NULL <p>The virtual inputs value will return to default value immediately on following invalid GOOSE messages conditions:</p> <ul style="list-style-type: none"> - TAL = 0 - The received GOOSE message has the test/ simulation flag set - The received GOOSE message has the NdsCom flag set - confRev is different from GoCB and NULL - all data missing first element or new front element - when the numDatSetEntries in a subscribed GOOSE message is less than the DO index which IED want to subscribe <p>The virtual inputs value will return to default value (False) immediately on following invalid GOOSE messages conditions:</p> <ul style="list-style-type: none"> - data type wrong configuration or disorder configuration
Gs_ex2	2	What is the behavior when the numDatSetEntries in a subscribed GOOSE message is more than DO index which IED want to subscribe	Accept as a normal GOOSE and parse GOOSE message

12 PIXIT FOR GOOSE PERFORMANCE

ID	Ed	Description	Value / Clarification	
Gf1	2	Performance class	P1	
Gf2	2	GOOSE ping-pong processing method	Event driven based	
Gf3	2	Application logic scan cycle (ms)	Max	500ms
			Min	100ms
Gf4	2	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	300	

13 PIXIT FOR CONTROL MODEL

ID	Ed	Description	Value / Clarification
Ct1	-	What control modes are supported (compare PICS)	Y DOns Y SBOs Y DOes Y SBOes
Ct2	2	Is the control model fixed, configurable and/or dynamic?	Configurable
Ct3	-	Is TimeActivatedOperate supported (compare PICS or SCL)	Deprecated
Ct4	-	Is “operate-many” supported (compare sboClass)	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 Ct12 is applicable)	N/A
Ct6	-	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	Deprecated
Ct7	-	Is pulse configuration supported (compare pulseConfig)	Deprecated
Ct8	1	What is the behavior of the DUT when the check conditions are set Is this behavior fixed, configurable, online changeable?	Y synchro-check N interlock-check DUT uses the check value to perform the check. Fixed
Ct9	2	What additional cause diagnosis are supported	Y Unknown Y Not-supported Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached N Parameter-change-in-execution N Step-limit Y Blocked-by-Mode N Blocked-by-process N Blocked-by-interlocking N Blocked-by-synchrocheck Y Command-already-in-execution N Blocked-by-health Y 1-of-n-control N Abortion-by-cancel N Time-limit-over N Abortion-by-trip Y Object-not-selected Edition 2 specific values: Y Object-already-selected N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss Y Blocked-by-command N None Y Inconsistent-parameters Y Locked-by-other-client
Ct10	2	How to force a “test-not-ok” respond with SelectWithValue request?	invalid OrCat value
Ct11	2	How to force a “test-not-ok” respond with Select request?	the control object is already selected by other client and SBO timeout does not expire
Ct12	2	How to force a “test-not-ok” respond with Operate request?	invalid OrCat value AddCause: Not-supported

ID	Ed	Description	Value / Clarification
Ct13	2	Which origin categories are supported/ accepted?	Y not-support Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process
Ct14	2	What happens if the orCat value is not supported or invalid	DONs: Control could be not execute SBOs: Control could be not execute DOes: Control could be not execute SBOes: Control could be not execute
Ct15	2	Does the IED accept a SelectWithValue / Operate with the same control value as the current status value Is this behaviour configurable	DONs: N AddCause: Position-reached SBOs: N AddCause: Position-reached DOes: N AddCause: Position-reached SBOes: N AddCause: Position-reached N
Ct16	2	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	Regardless of how or when a control select/operation is received by a MiCOM Px40 IED the same checks are always performed. The return condition for the request will depend upon many factors including: Is the control available or is it still operating from a previous request Is the received control value the same as the control status value In most instances, assuming the two received control request have the same control value, the second select request will result with an "Object-already-selected" response- in SBO control mode, and operate request will result with a "locked-by-other-client" Response-. DONs: See above detailed information. SBOs: See above detailed information. DOes: See above detailed information. SBOes: See above detailed information.
Ct17	1	Does the IED accept a select/selectwithvalue from the same client when the control object is already selected (Tissue #334)	SBOs: N SBOes: N
Ct18	2	Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?	Y for SelectWithValue and Operate
Ct19	-	Can a control operation be blocked by Mod=Off or [On-]Blocked (Compare PIXIT-Sr5)	Deprecated
Ct20	2	Does the IED support local / remote operation?	Y
Ct21	2	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security	SBOs: Y DONs: Y
Ct22	2	How to force a "parameter-change-in-execution"	N/A
Ct23	2	Can a controllable object be forced to keep its old state e.g. Internal Controllable Objects may not be accessible to force this, whereas a switch like Circuit Breaker outside the DUT can?	Y
Ct24	2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	Y

ID	Ed	Description	Value / Clarification
Ct25	2	Do any objects have Operate Timeout > 0	DOes: Y SBOes: Y 5 seconds (fixed)
Ct26	2	Does the IED support control objects with external signals?	DOns: N SBOs: N DOes: N SBOes: N
Ct27	2	Does the IED support DPC control objects with external signals?	DOns: N SBOs: N DOes: N SBOes: N
Ct_ex1	2	Is the control mode interlocked or non-interlocked?	Intelocked mode as default

14 PIXIT FOR TIME SYNCHRONISATION MODEL

ID	Ed	Description	Value / Clarification
Tm1	1	What time quality bits are supported (may be set by the IED)	Y LeapSecondsKnown (mandatory) N ClockFailure Y ClockNotSynchronized
Tm2	2	Describe the behaviour when the time server(s) ceases to respond What is the time server lost detection time	On one time server: If one time server ceases to respond, the IED automatically switch to synchronize with other active time server. On all time servers: If all the time servers cease to respond, the IED keeps the previous synchronization time. The quality bit "ClockNotSynchronized" will be set after a configured time period System/LLN0\$ST\$SyncSt provide an indication of the clock synchronization state in IED. TRUE: Clock is synchronized (Either by SNTP or IRIG-B) FALSE: Clock is not synchronized
Tm3	2	How long does it take to take over the new time from time server	SNTP 64s (configurable) IRIG-B 10s
Tm4	2	When is the time quality bit "ClockFailure" set	Not applicable for this IED
Tm5	2	When the time quality bit "Clock not synchronised" set?	The 'Clock not synchronized' bit at power-up has a default status of not synchronized (set to one (1)). When the clock becomes synchronized, the bit will be reset to zero (0). All available time synchronization sources will affect the 'Clock not synchronized' bit. These time sources include SNTP and where applicable, IRIG-B. When "Poll Rate" expires (It is configurable, default value is 64s), if the connection to time server is still lost, the time quality bit "Clock not synchronised" shall be set.
Tm6	-	Is the timestamp of a binary event adjusted to the configured scan cycle?	Deprecated
Tm7	1	Does the device support time zone and daylight saving?	Y
Tm8	2	Which attributes of the SNTP response packet are validated?	Y Leap indicator not equal to 3 Y Mode is equal to SERVER Y Originate Timestamp is equal to value sent by the SNTP client as Transmit Timestamp Y RX/TX timestamp fields are checked for reasonableness Y SNTP version 3 Y either unicast or anycast
Tm9	2	Do the COMTRADE files have local time or UTC time and is this configurable	The time in the name of the COMTRADE file is UTC time The time stamp recorded in COMTRADE file is local time Not Configurable

15 PIXIT FOR FILE TRANSFER MODEL

ID	Ed	Description	Value / Clarification
Ft1	1	<p>What is structure of files and directories</p> <p>Where are the COMTRADE files stored</p> <p>Are comtrade files zipped and what files are included in each zip file</p>	<p>directory structure /COMTRADE/ /COMTRADE_ALL/ /dr/ /LD/ /COMTRADE/ /COMTRADE_ALL/ /dr/ Not zipped includes:.cfg and .dat</p>
Ft2	2	Directory names are separated from the file name by	"/"
Ft3	1	The maximum file name size including path (recommended 64 chars)	<p>Disturbance record filenames are based around the following fixed format giving a maximum filename length of twenty eight (28) characters: yyyymmdd_HHMMSS_xxx_rNNN.* Where: yyyy = The year, i.e. 2006 mm = The month, i.e. 03 (for March) dd = The day of month, i.e. 15th HH = Hours in 24hr format, i.e. 12 MM = Minutes, i.e. 59 SS = Seconds, i.e. 59 xxx = Milli-seconds, i.e. 999 r = A literal 'r' character NNN = Disturbance record number, i.e. 001 * = The file type, either cfg or dat Taking into account the directory structure presented in section Ft1, this gives a maximum, fully qualified, filename length of forty four (44) characters.</p>
Ft4	2	Are directory/file name case sensitive	Case sensitive
Ft5	2	Maximum file size for SetFile	N/A
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name	N/A (Ed2: always complete path)
Ft7	1	Is the wild char supported MMS fileDirectory request	Y, wild card = *
Ft8	2	Is it allowed that 2 clients get a file at the same time?	Y
Ft9	2	Which files can be deleted	<p>.cfg and .dat files in /COMTRADE/ If .cfg file is deleted by client firstly, then the corresponding .dat file will be deleted automatically. The same way, If .dat file is deleted by client firstly, then the corresponding .cfg file will be deleted automatically</p>

16

PIXIT FOR SERVICE TRACKING MODEL

Not support.



Customer Care Centre

<http://www.schneider-electric.com/cc>

Schneider Electric

35 rue Joseph Monier
92506 Rueil-Malmaison
FRANCE

Phone: +33 (0) 1 41 29 70 00
Fax: +33 (0) 1 41 29 71 00

www.schneider-electric.com

Publisher: Schneider Electric

Publication: Easergy MiCOM P445/EN PX/G82 Fast Multifunction Distance Protection Relay Software Version: J7 Hardware Suffix: L IEC61850 Edition: 2

08/2017