

PACiS SPP T101

Gateway and C264

SPP/EN T101/D10

PACiS V5

Slave Protocol Profile
T101

Issue A

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1. SCOPE OF THE DOCUMENT

This document describes in parallel the serial communication protocol slave T101 implemented on:

- PACiS Gateway.
- MiCOM C264.

This document deals with communication with an upper level SCADA system.

2. 870-5-101 IEC:1995-> 2001 EDITION 2 – INTEROPERABILITY

This companion standard presents sets of parameters and alternatives from which subsets have to be selected to implement particular telecontrol systems. Certain parameter values, such as the number of bytes in the COMMON ADDRESS of ASDUs represent mutually exclusive alternatives. This means that only one value of the defined parameters is admitted per system. Other parameters, such as the listed set of different process information in command and in monitor direction allow the specification of the complete set or subsets, as appropriate for given applications. This clause summarises the parameters of the previous clauses to facilitate a suitable selection for a specific application. If a system is composed of equipment stemming from different manufacturers it is necessary that all partners agree on the selected parameters.

The selected parameters should be filled up (**N** => **S**).

NOTE 1: In addition, the full specification of a system may require individual selection of certain parameters for certain parts of the system, such as the individual selection of scaling factors for individually addressable measured values.

To simplify the PID, we use the following conventions:

- N** Not supported
- S** Supported
- S*** Supported with special consideration (see comments)

2.1 System or device

C264	GTW	Description
N	N	System definition
N	N	Controlling station definition (Master)
S	S	Controlled station definition (Slave)

2.2 Network configuration (Network-specific parameter)

C264	GTW	Description
S	S	Point-to-point
S	S	Multiple point-to-point
S	S	Multipoint-party line
S	S	Multipoint-star

NOTE: In balanced mode only "Point-to-point" and "Multiple point-to-point »

2.3 Physical layer (Network-specific parameter)

Transmission speed (control and monitor direction):

C264	GTW	Description
N	S*	100 bit/s
N	S*	200 bit/s
S	S	300 bit/s
S	S	600 bit/s
S	S	1 200 bit/s
S	S	2 400 bit/s
S	S	4 800 bit/s
S	S	9 600 bit/s
S	S	19 200 bit/s
S	S	38 400 bit/s
N	N	56 000 bit/s
N	N	57 600 bit/s
N	S**	64 000 bit/s

**Only with Acksys card.

* Gateway-PC uses a standard PC RS232 and is limited by the possibilities of this hardware. Using a dedicated hardware it is possible to configure 100 or 200 bit/s.

C264 uses RS232 or RS485 depending on configuration (Hardware part).

2.4 Link layer (Network-specific parameter)

(Network-specific parameter, all options that are used should be filled up (**N** => **S**). Specify the maximum frame length. If a non-standard assignment of class 2 messages is implemented for unbalanced transmission, indicate the type ID and COT of all messages assigned to class 2.)

Frame format FT 1.2, single character 1 and the fixed time out interval are used exclusively in this companion standard.

2.4.1 Link transmission procedure

C264	GTW	Description
S	S	Balanced transmission
S	S	Unbalanced transmission

2.4.2 Address field of the link

C264	GTW	Description
S	S	Not present (balanced transmission only)
S	S	One octet
S	S	Two octets
S	S	Structured
S	S	Unstructured

2.4.3 Frame length

C264	GTW	Description
up to 255	up to 255	Length L (number of bytes in <u>control</u> direction)
up to 255	up to 255	Length L (number of bytes in <u>monitor</u> direction) Maximum length of ASDU is configurable from 50 to 255.

2.4.4 Repetition parameters (only in balanced mode)

C264	GTW	Description
S	S	Number of repetitions on non-acknowledge frame. C264 fixed to: 2 GTW can be configured from 1 to 10.
S	S	Maximum time between information frame and controlling station acknowledgement. C264 fixed to: 1 second GTW can be configured from 2 seconds to 10 seconds

2.4.5 Class1 data

The following types of information are reported as class1 by the controlled station

C264	GTW	Description
S	S	Single point information with or without time tag (on change)
S	S	Double point information with or without time tag (on change)
S	S	Step position information with or without time tag (on change)
S	S	Measured value, normalised with or without time tag (on change)
S	S	Measured value, scaled with or without time tag (on change)
S	S	Measured value, floated with or without time tag (on change)
S	S	Integrated totals with or without time tag (on change)
S	S	Time messages
S	S	All command responses (ACT_CONF, and ACT_TERM)

2.4.6 Class 2 data

The following types of information are reported as class 2 by the controlled station:

C264	GTW	Description
S	S	Single point information (GI scan, or BackGroundScan cycle)
S	S	Double point information (GI scan, or BackGroundScan cycle)
S	S	Step position information (GI scan, or BackGroundScan cycle)
S	S	Measured values, normalised (GI scan, or Periodic cycle, or BackGroundScan cycle)
S	S	Measured values, scaled (GI scan, or Periodic cycle, or BackGroundScan cycle)
S	S	Measured values, floated (GI scan, or Periodic cycle, or BackGroundScan cycle)
S	S	Integrated totals (Counter GI scan)

NOTE: In response to a class 2 poll, a GTW may respond with class 1 data when there are no class 2 data available (parameter in registry) as per IEC 61870-5-101, Part 5, § 6.2.1.1.

2.5 Application layer

2.5.1 Transmission mode for application data

Mode 1 (Least significant octet first), as defined in clause 4.10 of IEC 870-5-4, is used exclusively in this companion standard.

2.5.2 Common address of ASDU

(System-specific parameter)

The address field of the link and the common address of ASDU could have a different number of bytes

C264	GTW	Description
S	S	One octet
S	S	Two octets

2.5.3 Information object address

(System-specific parameter)

C264	GTW	Description
S	S	One octet
S	S	Two octets
S	S	Three octets
S	S	Structured
S	S	Unstructured

2.5.4 Cause of transmission

(System-specific parameter)

C264	GTW	Description
S	S	One octet
S	S	Two octets (with originator address set to 0 if not used)

2.5.5 Selection of standard ASDUs

2.5.5.1 Process information in monitor direction

(Station-specific parameter)

C264	GTW	Description	
S	S	<1>: = Single-point information	M-SP-NA-1
S	S	<2>: = Single-point information with time tag	M-SP-TA-1
S	S	<3>: = Double-point information	M-DP-NA-1
S	S	<4>: = Double-point information with time tag	M-DP-TA-1
S	S*	<5>: = Step position information	M-ST-NA-1
S	S	<6>: = Step position information with time tag	M-ST-TA-1
N	S	<7>: = Bit-string of 32 bit	M-BO-NA-1
N	S	<8>: = Bit-string of 32 bit with time tag	M-BO-TA-1
S	S	<9>: = Measured value, normalised value	M-ME-NA-1
S	S	<10>: = Measured value, normalised value with time tag	M-ME-TA-1
S	S	<11>: = Measured value, scaled value	M-ME-NB-1
S	S	<12>: = Measured value, scaled value with time tag	M-ME-TB-1
S	S	<13>: = Measured value, short floating point value	M-ME-NC-1
S	S	<14>: = Measured value, short floating point value with time tag	M-ME-TC-1
S	S	<15>: = Integrated totals	M-IT-NA-1
S	S	<16>: = Integrated totals with time tag	M-IT-TA-1
N	N	<17>: = Event of protection equipment with time tag	M-EP-TA-1
S	S	<18>: = Packed starts events of protection equipment with time tag	M-EP-TB-1
S	S	<19>: = Packed output circuit information of protection equipment with time tag	M-EP-TC-1
N	N	<20>: = Packed single-point information with status change detection	M-PS-NA-1
N	N	<21>: = Measured value, normalised value without quality descriptor	M-ME-ND-1

* T bit not supported

2.5.5.2 Process information in monitor direction with the Extension of time tag

(Station-specific parameter)

C264	GTW	Description	
S	S	<30>: = Single-point information with time tag CP56Time2a	M-SP-TB-1
S	S	<31>: = Double-point information with time tag CP56Time2a	M-DP-TB-1
S	S*	<32>: = Step position information with time tag CP56Time2a	M-ST-TB-1
N	S	<33>: = Bit-string of 32 bit with time tag CP56Time2a	M-BO-TB-1
S	S	<34>: = Measured value, normalised value with time tag CP56Time2a	M-ME-TD-1
S	S	<35>: = Measured value, scaled value with time tag CP56Time2a	M-ME-TE-1
S	S	<36>: = Measured value, short floating point value, time tag CP56Time2a	M-ME-TF-1
S	S	<37>: = Integrated totals with time tag CP56Time2a	M-IT-TB-1
N	N	<38>: = Event of protection equipment with time tag CP56Time2a	M-EP-TD-1
S	S	<39>: = Packed start event of protection equipment, time tag CP56Time2a	M-EP-TE-1
S	S	<40>: = Packed output circuit information of protection equipment with time tag CP56Time2a	M-EP-TF-1

* T bit not supported

2.5.5.3 Process information in control direction

(station-specific parameter)

C264	GTW	Description	
S	S	<45>: = Single command	C-SC-NA-1
S	S	<46>: = Double command	C-DC-NA-1
S	S	<47>: = Regulating step command	C-RC-NA-1
S	S	<48>: = Set point command normalised value	C-SE-NA-1
S	S	<49>: = Set point command scaled value	C-SE-NB-1
S	S	<50>: = Set point command, short floating point value	C-SE-NC-1
N	N	<51>: = Bit-string of 32 bit	C-BO-NA-1

2.5.5.4 System information in monitor direction

(station-specific parameter)

C264	GTW	Description	
S	S	<70>: = End of initialisation	M-EI-NA-1

2.5.5.5 System information in control direction

(station-specific parameter)

C264	GTW	Description	
S	S	<100>: = Interrogation commands	C-IC-NA-1
S	S	<101>: = Counter interrogation command	C-CI-NA-1
N	S*	<102>: = Read command	C-RD-NA-1
S***	S****	<103>: = Clock synchronisation command	C-CS-NA-1
S	S	<104>: = Test command	C-TS-NA-1
S**	S	<105>: = Reset process command	C-RP-NA-1
S	N	<106>: = Delay acquisition command	C-CD-NA-1

* Only if the IOA is unique for all datapoint whatever the type.

** In C264, used to empty fifo if QRP = 2 and nothing if QRP = 1 .

In C264R , used to empty fifo if QRP = 2 and switch database if QRP = 1.

*** if no other synchronization source is set on the system, C264 will POS ACK (Positively acknowledge) and take into account the new time and date received. However, the IV bit is automatically set after 360 seconds when no new time synchronization occurs.

**** Clock synchronization is subject to system wide parameters: if the PACiS system is already synchronized by a GPS clock (usually at C264 level), any incoming ASDU 103 will not be taken into account, i.e. the time/date received won't be used to synchronize other equipments. However, the incoming ASDU 103 frame will be properly responded either POS ACK either NEG ACK depending on a setting in Windows registry database.

2.5.5.6 Parameter in control direction

(station-specific parameter)

C264	GTW	Description	
N	N	<110>: = Parameter of measured value, normalised value	P-ME-NA-1
N	N	<111>: = Parameter of measured value, scaled value	P-ME-NB-1
N	N	<112>: = Parameter of measured value, short floating point value	P-ME-NC-1
N	N	<113>: = Parameter activation	P-AC-NA-1

2.5.5.7 File transfer

(station-specific parameter)

C264	GTW	Description	
S	S	<120>: = File ready	F-FR-NA-1
S	S	<121>: = Section ready	F-SR-NA-1
S	S	<122>: = Call directory, select file, call file, call section	F-SC-NA-1
S	S	<123>: = Last section, last segment	F-LS-NA-1
S	S	<124>: = Ack file, ack section	F-AF-NA-1
S	S	<125>: = Segment	F-SG-NA-1
S	S	<126>: = Directory	F-DR-TA-1


2.5.5.8 Special use
(private range)

C264	GTW	Description	
S	N	<137>: = Regulating delay command	C-RC-NB-1

2.5.5.9 Mapping PACiS

PACiS Objects	ASDU	Format
Single Point Status (SPS)	<1>, <2>, <30>	
Double Point Status (DPS)	<3>, <4>, <31>	
Tape Position Indicator (TPI)	<5>, <6>, <32>	
Multiple Point Status (MPS)	<18> (PSE), <19> (POC): only C264 <7>, <8>, <33>: only GTW	
Measurement (MV)	<9>, <10>, <34>	Normalised
	<11>, <12>, <35>	Adjusted
	<13>, <14>, <36>	Float
Counter (CT)	<15>, <16>, <37>	
Single Point Command (SPC)	<45>	
Double Point Command (DPC)	<46>	
Set point Command (SP)	<48>	Normalised
	<49>	Adjusted
	<50>	Float

2.5.5.10 Type identifier and cause of transmission assignments
(station-specific parameters)

	Mark type identification/cause of transmission combinations:
X	'X' if used by Gateway And C264
C	'C' if only used by C264
G	'G' if only used by Gateway
G*	Can be set in Windows registry database. Gateway only.
	Shaded boxes are not required but may be supported when X/C/G appears inside.
	Blank = function or ASDU not implemented into PACiS
	Required in 1995 standard, suppressed in 2000 standard.

		Cause of transmission																			
		periodic, cyclic	background scan	spontaneous	Initialized	request	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	Return cause of remote command	Return cause of local command	File transfer	General Interro Interro by group n	Req by gen counter	Req by group n counter	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<1>	M_SP_NA_1		X	X		X						X	X		X						
<2>	M_SP_TA_1		G*	X								X	X		G*						
<3>	M_DP_NA_1		X	X		X						X	X		X						
<4>	M_DP_TA_1		G*	X								X	X		G*						
<5>	M_ST_NA_1		X	X		X						X	X		X						
<6>	M_ST_TA_1		G*	X								X	X		G*						
<7>	M_BO_NA_1		G	X		X									X						
<8>	M_BO_TA_1		=	X											=						
<9>	M_ME_NA_1	X	X	X		X									X						
<10>	M_ME_TA_1		G*	X											G*						
<11>	M_ME_NB_1	X	X	X		X									X						
<12>	M_ME_TB_1		G*	X											G*						
<13>	M_ME_NC_1	X	X	X		X									X						
<14>	M_ME_TC_1		G*	X											G*						
<15>	M_IT_NA_1			X												X					
<16>	M_IT_TA_1			X												X					
<17>	M_EP_TA_1																				
<18>	M_EP_TB_1			X																	
<19>	M_EP_TC_1			X																	
<20>	M_PS_NA_1																				
<21>	M_ME_ND_1																				
<30>	M_SP_TB_1			X								X	X		G*						
<31>	M_DP_TB_1			X								X	X		G*						
<32>	M_ST_TB_1			X								X	X		G*						
<33>	M_BO_TB_1																				
<34>	M_ME_TD_1			X											G*						
<35>	M_ME_TE_1			X											G*						
<36>	M_ME_TF_1			X											G*						

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		Cause of transmission																			
		periodic, cyclic	background scan	spontaneous	Initialized	request	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	Return cause of remote command	Return cause of local command	File transfer	General Interro Interro by group n	Req by gen counter	Req by group n counter	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<37>	M_IT_TB_1			X												X					
<38>	M_EP_TD_1																				
<39>	M_EP_TE_1			X																	
<40>	M_EP_TF_1			X																	
<45>	C_SC_NA_1						X	X	X	X	X						X	X	X	X	
<46>	C_DC_NA_1						X	X	X	X	X						X	X	X	X	
<47>	C_RC_NA_1						X	X	X	X	X						C	X	X	X	
<48>	C_SE_NA_1						X	X	X	X	X							X	X	X	
<49>	C_SE_NB_1						X	X	X	X	X							X	X	X	
<50>	C_SE_NC_1						X	X	X	X	X							X	X	X	
<51>	C_BO_NA_1																C				
<70>	M_EI_NA_1				X																
<100>	C_IC_NA_1						X	X	X	X	X						X	X	X	X	
<101>	C_CI_NA_1						X	X			X							X	X	X	
<102>	C_RD_NA_1					X															
<103>	C_CS_NA_1			X			X	X									C	X	X	X	
<104>	C_TS_NA_1						X	X									X	X	X	X	
<105>	C_RP_NA_1						X	X									X	X	X	X	
<106>	C_CD_NA_1						X	X										X	X	X	
<110>	P_ME_NA_1																	X			
<111>	P_ME_NB_1																	X			
<112>	P_ME_NC_1																	X			
<113>	P_AC_NA_1																	X			
<120>	F_FR_NA_1													X				X	X	X	
<121>	F_SR_NA_1													X				X	X	X	
<122>	F_SC_NA_1													X				X	X	X	
<123>	F_LS_NA_1													X				X	X	X	
<124>	F_AF_NA_1													X				X	X	X	
<125>	F_SG_NA_1													X				X	X	X	

		Cause of transmission																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
		periodic, cyclic	background scan	spontaneous	Initialized	request	activation	activation confirmation	deactivation	deactivation confirmation	activation termination	Return cause of remote command	Return cause of local command	File transfer	General Interro Interro by group n	Req by gen counter Req by group n counter	unknown type identification	unknown cause of transmission	unknown common address of ASDU	unknown information object address	
<126>	F_DR_TA_1		G*	X		X															
<136>	M_DB_NA_1																C				
<137>	C_RC_NB_1						C	C	C	C	C							C	C	C	C

2.6 Basic application functions

2.6.1 Station initialisation

(Station-specific parameter)

C264	GTW	Description
S*	S**	Remote initialisation

* only implemented for QRP=2 (reset of pending information with time tag of the event buffer)

** not only restart the Gateway software but also reboot the computer

2.6.2 Cyclic data transmission

(Station-specific parameter)

C264	GTW	Description
S	S	Cyclic data transmission

(It's the same cyclic for all data).

2.6.3 Read procedure

(Station-specific parameter)

C264	GTW	Description
S	S	Read procedure

2.6.4 Spontaneous transmission

(Station-specific parameter)

C264	GTW	Description
S	S	Spontaneous transmission

2.6.5 Double transmission of information objects with cause of transmission spontaneous

(station-specific parameter), each information is marked where both a Type ID without time and corresponding Type ID with time are issued in response to a single spontaneous change of a monitored object

The following type identifications may be transmitted in succession caused by a single status change of an information object. The particular information object addresses for which double transmission is enabled are defined in a project-specific list.

C264	GTW		
N	N	Single point information	M_SP_NA_1, M_SP_TA_1, M_SP_TB_1 and M_PS_NA_1
N	N	Double point information	M_DP_NA_1, M_DP_TA_1 and M_DP_TB_1
N	N	Step position information	M_ST_NA_1, M_ST_TA_1 and M_ST_TB_1
N	N	Bitstring of 32 bit	M_BO_NA_1, M_BO_TA_1 and M_BO_TB_1 (if defined for a specific project)
N	N	Measured value, normalized value	M_ME_NA_1, M_ME_TA_1, M_ME_ND_1 and M_ME_TD_1
N	N	Measured value, scaled value	M_ME_NB_1, M_ME_TB_1 and M_ME_TE_1
N	N	Measured value, short floating point number	M_ME_NC_1, M_ME_TC_1 and M_ME_TF_1

2.6.6 Link state between Controlling and Controlled station

C264	GTW	Description
S	S	Management of the COM lost (Problem detecting on the link)
S	S	Management of the COM recovering (Problem not detecting on the link)

2.6.7 General interrogation

(System or station-specific parameter)

C264	GTW	Description	C264	GTW	Description	C264	GTW	Description
S	S	Global						
S	S	Group 1	S	S	Group 7	S	S	Group 13
S	S	Group 2	S	S	Group 8	S	S	Group 14
S	S	Group 3	S	S	Group 9	S	S	Group 15
S	S	Group 4	S	S	Group 10	S	S	Group 16
S	S	Group 5	S	S	Group 11			
S	S	Group 6	S	S	Group 12			

Addresses per group have to be defined

2.6.8 Counter General interrogation
(System or station-specific parameter)

C264	GTW	Description	C264	GTW	Description
S	S	Global			
S	S	Group 1	S	S	Group 3
S	S	Group 2	S	S	Group 4

2.6.9 Clock synchronisation
(Station-specific parameter)

C264	GTW	Description
S	S*	Clock synchronisation

* See Synchronisation paragraph.

C264	GTW	Description
S	S	Day of Week (1-Monday to 7-Sunday)
N	N	RES1, GEN (timetag substituted/not substituted) used
S	S	SU-bit (summertime) used

2.6.10 Command transmission
(Object-specific parameter)

C264	GTW	Description
S	S	Direct command transmission
S	S	Direct set point command transmission
S	S	Select and execute command
S	S	Select and execute set point command

C264	GTW	Description
S	S	No additional definition
S*	S*	Short pulse duration (**)
S*	S*	Long pulse duration (**)
S*	S*	Persistent output (***)

* supported by link level but is not transmitted to application level.

(**) Pulse duration shall be defined in configuratio of the outstation..

(***) Type pulse or persistant is defined in the configuration of the outstation.

2.6.11 Transmission of integrated totals

(Station or object-specific parameter)

C264	GTW	Description
S	S	Mode A: local freeze with spontaneous.
N	N	Mode B: local freeze with counter.
S	S	Mode C: freeze and transmit by counter interrogation.
N	N	Mode D: freeze by counter interrogation command, frozen values reported.

2.6.12 Counter General interrogation

(Object-specific parameter)

C264	GTW	Description
S	S	Counter read
S	S	Counter freeze without reset
S	S	Counter freeze with reset
S	S	Counter reset

C264	GTW	Description
S	S	General request counter
S	S	Request counter group 1
S	S	Request counter group 2
S	S	Request counter group 3
S	S	Request counter group 4

2.6.13 Parameter loading

(Object-specific parameter)

C264	GTW	Description
N	N	Threshold value
S*	S*	Smoothing factor
N	N	Low limit for transmission of measured value
N	N	High limit for transmission of measured value

* Smoothing factor & Thresholds is supported by link level, even if not transmitted to application level.

2.6.14 Parameter activation

(Object-specific parameter)

C264	GTW	Description
N	N	Act/Desactivation of persistent cyclic or periodic transmission of the addressed object

2.6.15 Test procedure

(Station-specific parameter)

C264	GTW	Description
S	S	Test procedure

2.6.16 File transfer

(Station-specific parameter)

File transfer in monitor direction

C264	GTW	Description
S	S	Transparent file (for disturbance files)
N	N	Transmission of disturbance data of protection equipment
S	S	Transmission of sequences of events (T101, S900)
N	N	Transmission of sequences of recorded analogue values

File transfer in control direction

C264	GTW	Description
S*	N	Transparent file

* Only for C264R for Database transfert

2.6.17 Background scan

(Station-specific parameter)

C264	GTW	Description
S	S	Background scan

2.6.18 Acquisition of transmission delay

(Station-specific parameter)

C264	GTW	Description
S	S	Acquisition of transmission delay

2.6.19 Management events priorities

(Station-specific parameter)

C264	GTW	Description
N	S	Digital Inputs, Step-position, Analogues Inputs and Integrated Totals, management events priorities.

See T101 standard Amendment 2 §7.2.2.2

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Publication: SPP/EN T101/D10

Publishing: Schneider Electric

06/2013