

MV electrical network management

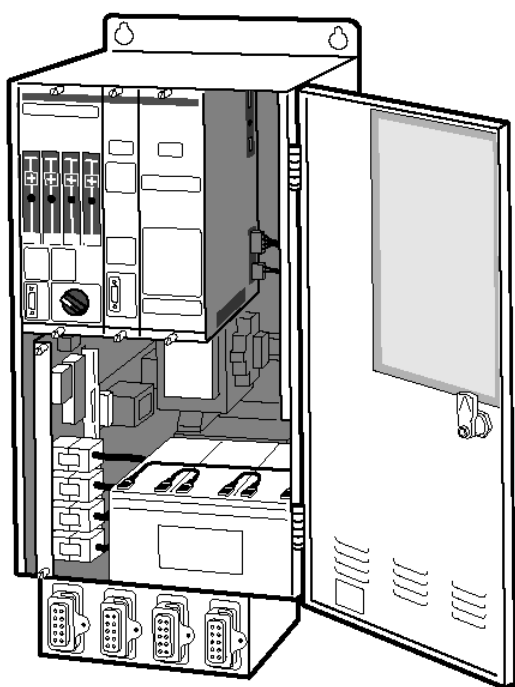
Easergy range

T200 & Flair 200C & R200-ATS100

MV substation control and monitoring units

IEC 870-5-104 communication

Appendix to the User Manual



Schneider
Electric

1.

ABOUT THE BOOK

3

2.

IEC 60 870-5-104

4

2.1.

PRESENTATION

4

2.2.

INTEROPERABILITY TABLE

5

2.3.

PROTOCOL CHARACTERISTICS

17

Transmission pile size

17

Possible data-flow

17

Configuration

17

R200-ATS100 Configuration

19

2.4.

BIBLIOGRAPHY

20

3.

OBJECT ADDRESSING

21

1. About the book

Presentation	
Document scope	This manual describes the IEC 870-5-104 protocol implementation on T200 and Flair 200C products
Application field	Apply to T200 and Flair 200C products
Document's evolutions	V1.0: Creation of IEC 870-5-104 user's manual. V1.1: Flair 200C added V1.2: T200 V3.3 release : - Redundancy until 8 connections - Dating validity through SNTP V1.3 : Interoperability table update, add of Set point Commands
Related documents	
User comments	

2. IEC 60 870-5-104

2.1. Presentation

Definition

- The IEC 60870-5-104 protocol is derived from the IEC 60870-5-101 protocol. This one was specified on a serial link whereas IEC 60870-5-104 is an application running on a TCP/IP layer
- Main differences between the 2 protocols are :
 - management of the TCP/IP layer interface (APCI)
 - new functions (ASDU) that have been added.

IEC 60870-5-101 protocol specifies frame format and the IEC 60870-5-104 protocol specifies the frame format of the transport interface (APCI) as well as exchanging rules between two equipments. Thus the equipment can communicate with a supervisor (or another equipment).

ISO Model

The IEC 60870-5-104 protocol is based on TCP/IP transport profile. It is located exclusively on layer 7 of the ISO model but can be considered as made of two sub-layers :

- Transport interface : APCI (Application Protocol control Information)
- ASDU from IEC 60870-5-101 and IEC 60870-5-104 selection

Transmission mode

The protocol is client – server application. The equipment is acting as a server, and the supervisor (SCADA) is acting as the client and connect the server.

Data

The IEC 870-5-104 protocol specifies the data that can be exchanged and the format used for transmission. Among the different data types provided by the protocol, we can quote:

- signalisations (singles or doubles),
- measured values (with different formats),
- integrated totals,
- commands,
- parameters.

Features

Features are associated to particular data types. For example :

- general interrogation,
- clock synchronisation,
- events transmission (time-stamped or not),
- integrated totals specific treatment (freezing, reset,...)
- command transmission modes (select and execute mode or direct mode)
- parameters activation.

Interoperability

Depending on their specifications, connected equipments do not use the same data types or features define by the protocol

In order to evaluate the compatibility between different equipments that should be connected, each manufacturer provides a document, called Interoperability table, where the used data and features are shown and detailed.

2.2. Interoperability Table

REMARKS

This companion standard presents sets of parameters and alternatives from which subsets must be selected to implement particular telecontrol systems. Certain parameter values, such as the choice of “structured” or “unstructured” fields of the INFORMATION OBJECT 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 summarizes 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 interoperability list is defined as in IEC 60870-5-101 and extended with parameters used in this standard. The text descriptions of parameters which are not applicable to this companion standard are strike-through (corresponding check box is marked black).

System or device system-specific parameter, indicate the station's function by marking one of the following with 'X'

- ☐ System definition
- ☐ Controlling station definition (MASTER)
- ☒ Controlled station definition (SLAVE)

Network Configuration network-specific parameter, all configurations that are used are to be marked 'X'

- ☒ Point-to-point
- ☒ Multipoint-party line
- ☒ Multiple point-to-point
- ☒ Multipoint-star

Physical layer network-specific parameter, all interfaces and data rates that are used are to be marked 'X'

Transmission speed

Control direction

Unbalanced interchange Circuit V.24/V.28 Standard	Unbalanced interchange Circuit V.24/V.28 Recommended if >1200bit/s	Balanced interchange Circuit X.24/X.27	
☒ 100-bit/s	☒ 2-400-bit/s	☒ 2-400-bit/s	☒ 56-000-bit/s
☒ 200-bit/s	☒ 4-800-bit/s	☒ 4-800-bit/s	☒ 64-000-bit/s
☒ 300-bit/s	☒ 9-600-bit/s	☒ 9-600-bit/s	
☒ 600-bit/s		☒ 19-200-bit/s	
☒ 1-200-bit/s		☒ 38-400-bit/s	

Transmission speed

Monitor direction

Unbalanced interchange Circuit V.24/V.28 Standard		Unbalanced interchange Circuit V.24/V.28 Recommended if >1 200bit/s		Balanced interchange Circuit X.24/X.27			
	100 bit/s		2 400 bit/s		2 400 bit/s		56 000 bit/s
	200 bit/s		4 800 bit/s		4 800 bit/s		64 000 bit/s
	300 bit/s		9 600 bit/s		9 600 bit/s		
	600 bit/s				19 200 bit/s		
	1 200 bit/s				38 400 bit/s		

LINK LAYER

network-specific parameter, all options that are used are to be marked 'X'. 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.

Link transmission procedure		Address field of the link	
	Balanced transmission		Not present (balanced transmission only)
	Unbalanced transmission		One octet
Frame length			Two octets
	maximum length L (number of octets)		Structured
			Unstructured

When using an unbalanced link layer, the following ASDU types are returned in class 2 messages (low priority) with the indicated causes of transmission:

The standard assignment of ASDUs to class 2 messages is used as follows:

Type identification	Cause of transmission
9, 11, 13, 21	<1>

A special assignment of ASDUs to class 2 messages is used as follows:

Type identification	Cause of transmission
---------------------	-----------------------

NOTE : In response to a class 2 poll, a controlled station may respond with class 1 data when there is no class 2 data available

Application layer

TRANSMISSION
MODE FOR
APPLICATION DATA :

Mode 1 (Least significant octet first), as defined in clause 4.10 of IEC 60870-5-4, is used exclusively in this companion standard..



Common
Address of
ASDU

system-specific parameter, all configurations that are used are to be marked 'X'



One octet



Two octets

Information object
address

system-specific parameter, all configurations that are used are to be marked 'X'



One octet



Structured



Two octets



Unstructured



Three octets

Cause of
transmission

system-specific parameter, all configurations that are used are to be marked 'X'



One octet



Two octets (with originator address)
originator address is set to zero

Length of APDU

system-specific parameter, specify the maximum length of the APDU per system

The maximum length of the APDU is 253 (default). The maximum length may be reduced by the system.



Maximum length of APDU per system

Selection of standard ASDUs

PROCESS
INFORMATION
IN MONITOR
DIRECTION

station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions



<1>

: Single-point information

M_SP_NA_1



<2>

: ~~Single-point information with time tag~~

M_SP_TA_1



<3>

: Double-point information

M_DP_NA_1



<4>

: ~~Double-point information with time tag~~

M_DP_TA_1



<5>

: Step position information

M_ST_NA_1

☒	<6>	: Step position information with time tag	M_ST_TA_1
☐	<7>	: Bit string of 32 bit	M_BO_NA_1
☒	<8>	: Bit string of 32 bit with time tag	M_BO_TA_1
☒	<9>	: Measured value, normalized value	M_ME_NA_1
☒	<10>	: Measured value, normalized value with time tag	M_ME_TA_1
☒	<11>	: Measured value, scaled value	M_ME_NB_1
☒	<12>	: Measured value, scaled value with time tag	M_ME_TB_1
☒	<13>	: Measured value, short floating point value	M_ME_NC_1
☒	<14>	: Measured value, short floating point value with time tag	M_ME_TC_1
☒	<15>	: Integrated totals	M_IT_NA_1
☒	<16>	: Integrated totals with time tag	M_IT_TA_1
☒	<17>	: Event of protection equipment with time tag	M_EP_TA_1
☒	<18>	: Packed start events of protection equipment with time tag	M_EP_TB_1
☒	<19>	: Packed output circuit information of protection equipment with time tag	M_EP_TC_1
☐	<20>	: Packed single-point information with status change detection	M_PS_NA_1
☐	<21>	: Measured value, normalized value without quality descriptor	M_ME_ND_1
☒	<30>	: Single-point information with time tag CP56Time2a	M_SP_TB_1
☒	<31>	: Double-point information with time tag CP56Time2a	M_DP_TB_1
☐	<32>	: Step position information with time tag CP56Time2a	M_ST_TB_1
☐	<33>	: Bit string of 32 bit with time tag CP56Time2a	M_BO_TB_1
☒	<34>	: Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
☒	<35>	: Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
☒	<36>	: Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
☒	<37>	: Integrated totals with time tag CP56Time2a	M_IT_TB_1
☐	<38>	: Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
☐	<39>	: Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
☐	<40>	: Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

Either the ASDUs of the set <2>, <4>, <6>, <8>, <10>, <12>, <14>, <16>, <17>, <18>, <19> or of the set <30> – <40> are used

Process information in control direction station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

☒	<45>	: Single command	C_SC_NA_1
☒	<46>	: Double command	C_DC_NA_1
☐	<47>	: Regulating step command	C_RC_NA_1
☒	<48>	: Set point command, normalized value	C_SE_NA_1
☒	<49>	: Set point command, scaled value	C_SE_NB_1

☒	<50>	: Set point command, short floating point value	C_SE_NC_1
☐	<51>	: Bit string of 32 bit	C_BO_NA_1
☒	<58>	: Single command with time tag CP56Time 2a	C_SC_TA_1
☒	<59>	: Double command with time tag CP56Time 2a	C_DC_TA_1
☐	<60>	: Regulating step command with time tag CP56Time 2a	C_RC_TA_1
☒	<61>	: Set point command, normalized value with time tag CP56Time 2a	C_SE_TA_1
☒	<62>	: Set point command, scaled value with time tag CP56Time 2a	C_SE_TB_1
☒	<63>	: Set point command, short floating point value with time tag CP56Time 2a	C_SE_TC_1
☐	<64>	: Bit string of 32 bit with time tag CP56Time 2a	C_BO_TA_1

Either the ASDUs of the set <45> – <51> or of the set <58>-<64> are used.

System information in monitor direction

station-specific parameter, mark 'X' if used

☒	<70>	:= End of initialization	M_EI_NA_1
-------------------------------------	------	--------------------------	-----------

System information in control direction

station-specific parameter, mark 'X' if used

☒	<100>	:= Interrogation command	C_IC_NA_1
☒	<101>	:= Counter interrogation command	C_CI_NA_1
☒	<102>	:= Read command	C_RD_NA_1
☒	<103>	:= Clock synchronization command	C_CS_NA_1
☐	<104>	: Test command	C_TS_NA_1
☒	<105>	:= Reset process command	C_RP_NA_1
☐	<106>	:= Delay acquisition command	C_CD_NA_1
☐	<107>	:= Test command with time tag CP56time2a	C_TS_TA_1

Parameter in control direction

station-specific parameter, mark 'X' if used

☐	<110>	:= Parameter of measured value, normalized value	P_ME_NA_1
☐	<111>	:= Parameter of measured value, scaled value	P_ME_NB_1
☐	<112>	:= Parameter of measured value, short floating point value	P_ME_NC_1
☐	<113>	:= Parameter activation	P_AC_NA_1

File Transfer

station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

☐	<120>	:= File ready	F_FR_NA_1
☐	<121>	:= Section ready	F_SR_NA_1
☐	<122>	:= Call directory, select file, call file, call section	F_SC_NA_1
☐	<123>	:= Last section, last segment	F_LS_NA_1
☐	<124>	:= Ack file, ack section	F_AF_NA_1
☐	<125>	:= Segment	F_SG_NA_1
☐	<126>	:= Directory (blank or X, only available in monitor (standard) direction)	F_DR_TA_1

■ Type identifier and causes of transmission assignment

station-specific parameters

Shaded boxes are not required.

Black boxes are not permitted in this companion standard

Blank: functions or ASDU not used.

Mark Type Identification/Cause of transmission combinations:

'X' if only used in the standard direction

'R' if only used in the reverse direction

'B' if used in both directions

Type Identification		Cause of transmission																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 à 36	37 à 41	44	45	46	47
<1>	M SP NA 1			X		X									X					
<2>	M SP TA 1																			
<3>	M DP NA 1			X		X									X					
<4>	M DP TA 1																			
<5>	M ST NA 1																			
<6>	M ST TA 1																			
<7>	M BO NA 1																			
<8>	M BO TA 1																			
<9>	M ME NA 1	X		X		X									X					
<10>	M ME TA 1																			
<11>	M ME NB 1	X		X		X									X					
<12>	M ME TB 1																			
<13>	M ME NC 1	X		X		X									X					
<14>	M ME TC 1																			
<15>	M IT NA 1			X												X				
<16>	M IT TA 1																			
<17>	M EP TA 1																			
<18>	M EP TB 1																			
<19>	M EP TC 1																			
<20>	M PS NA 1																			
<21>	M ME ND 1																			
<30>	M SP TB 1			X		X														
<31>	M DP TB 1			X		X														
<32>	M ST TB 1																			
<33>	M BO TB 1																			

<34>	M_ME_TD_1			X	X													
<35>	M_ME_TE_1			X	X													
<36>	M_ME_TF_1			X	X													
<37>	M_IT_TB_1			X									X					
<38>	M_EP_TD_1																	
<39>	M_EP_TE_1																	
<40>	M_EP_TF_1																	
<45>	C_SC_NA_1					X	X	X	X	X								
<46>	C_DC_NA_1					X	X	X	X	X								
<47>	C_RC_NA_1																	
<48>	C_SE_NA_1					X	X	X	X	X								
<49>	C_SE_NB_1					X	X	X	X	X								
<50>	C_SE_NC_1					X	X	X	X	X								
<51>	C_BO_NA_1																	
<58>	C_SC_TA_1					X	X	X	X	X								
<59>	C_DC_TA_1					X	X	X	X	X								
<60>	C_RC_TA_1																	
<61>	C_SE_TA_1					X	X	X	X	X								
<62>	C_SE_TB_1					X	X	X	X	X								
<63>	C_SE_TC_1					X	X	X	X	X								
<64>	C_BO_TA_1																	
<70>	M_EI_NA_1				X													
<100>	C_IC_NA_1					X	X	X	X	X								
<101>	C_CI_NA_1					X	X			X								
<102>	C_RD_NA_1					X												
<103>	C_CS_NA_1					X	X											
<104>	C_TS_NA_1																	
<105>	C_RP_NA_1					X	X											
<106>	C_CD_NA_1																	
<107>	C_TS_TA_1																	
<110>	P_ME_NA_1																	
<111>	P_ME_NB_1																	
<112>	P_ME_NC_1																	
<113>	P_AC_NA_1																	
<120>	F_FR_NA_1																	
<121>	F_SR_NA_1																	
<122>	F_SC_NA_1																	
<123>	F_LS_NA_1																	
<124>	F_AF_NA_1																	
<125>	F_SG_NA_1																	
<126>	F_DR_TA_1 ^{a)}																	

^{a)} Blank or X only

Basic application functions

Station initialization station-specific parameter, mark 'X' if function is used

☒ Remote initialization

Cyclic data transmission station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

☒ Cyclic data transmission

Read procedure station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

☒ Read Procedure

Spontaneous transmission station-specific parameter, mark 'X' if function is used

☒ Spontaneous transmission

Double transmission of information objects with cause of transmission spontaneous station-specific parameter, mark each information type 'X' 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

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

Station Interrogation

station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

Clock synchronization

station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions.

☒	global				
☐	group 1	☐	group 7	☐	group 13
☐	group 2	☐	group 8	☐	group 14
☐	group 3	☐	group 9	☐	group 15
☐	group 4	☐	group 10	☐	group 16
☐	group 5	☐	group 11	Information Object Addresses assigned to each group must be shown in a separate table	
☐	group 6	☐	group 12		

☒	Clock synchronization
-------------------------------------	-----------------------

Command transmission

station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions.

☒	Direct command transmission
☐	Direct set point command transmission
☒	Select and execute command
☐	Select and execute set point command
☐	C_SE ACTTERM used
☒	No additional definition
☐	Short pulse duration (duration determined by a system parameter in the outstation)
☐	Long pulse duration (duration determined by a system parameter in the outstation)
☐	Persistent output
☒	Supervision of maximum delay in command direction of commands and set point commands
60 s	Maximum allowable delay of commands and set point commands

Transmission of integrated totals station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

- ☒ Mode A: Local freeze with spontaneous transmission
- ☐ Mode B: Local freeze with counter interrogation
- ☐ Mode C: Freeze and transmit by counter-interrogation commands
- ☐ Mode D: Freeze by counter-interrogation command, frozen values reported spontaneously
- ☐ Counter read
- ☐ Counter freeze without reset Counter freeze with reset
- ☐ Counter reset
- ☒ General request counter
- ☐ Request counter group 1
- ☐ Request counter group 2
- ☐ Request counter group 3
- ☐ Request counter group 4

Parameter loading station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

- ☐ Threshold value
- ☐ Smoothing factor
- ☐ Low limit for transmission of measured values
- ☐ High limit for transmission of measured values

Parameter activation station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

- ☐ Act/deact of persistent cyclic or periodic transmission of the addressed object

Test procedure station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

- ☐ Test Procedure

File transfer station-specific parameter, mark 'X' if function is used

File transfer in monitor direction

- ☐ Transparent file
- ☐ Transmission of disturbance data of protection equipment
- ☐ Transmission of sequences of events
- ☐ Transmission of sequences of recorded analog values

File transfer in control direction

- ☐ Transparent file

Background scan

station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions

- ☐ Background scan

Acquisition of transmission delay

- ☒ Acquisition of transmission delay

Definition of time-outs

Parameter	Default value	Remarks	Selected value
t0	30 s	Time-out of connection establishment	30 s
t1	15 s	Maximum time to wait until the Supervisor indicates that it has correctly received the frame previously send by the unit. If the confirmation is not received, the session is closed.	Configurable
t2	10 s	Maximum time to wait before to send a S frame confirmation for frames received from the Supervisor. (T2 < T1)	Configurable
t3	20 s	If no data transfers occur during a certain period of time, a frame will be send to test the link. (T3>T1)	Configurable

Maximum range of values k: 1 to 32767 (215-1) APDUs, accuracy 1 APDU
Maximum range of values w: 1 to 32767 APDUs, accuracy 1 APDU (Recommendation: w should not exceed two-thirds of k).

Because of memory limitations, k and w are limited to 20 APDUs with w < k

Port Number

Parameter	Value	Remark
Port number	2404	configurable

8

Number N of redundancy group connections used. (T200 only)

RFC 2200 suite

RFC 2200 is an official Internet Standard which describes the state of standardization of protocols used in the Internet as determined by the Internet Architecture Board (IAB). It offers a broad spectrum of actual standards used in the Internet. The suitable selection of documents from RFC 2200 defined in this standard for given projects has to be chosen by the user of this standard.

2.3. Protocol Characteristics

Transmission pile size

Transmission pile is linked to the number of events that can be kept in memory as long as the SCADA has not read them. This is important when communication is lost or when the events flow is bigger than the protocol data-flow. In all cases, those events are lost in case of equipment shut down.

The equipment deals with digitals information (TOR), integrated totals or measured values. The size of the transmission pile is 350 events for each type

Possible data-flow

With a point to point connection on an 10/100Mb/s Ethernet link, the protocol is able to transmit 1000 events per seconds.

WARNING : Performances are dependent on the Ethernet network.

Configuration

The list of available parameters is the following :

		Home																													
		Administrator EASERGY Distant																													
Monitoring		Control		Diagnostic				Maintenance				Settings																			
Protocol Parameters IEC 60870-5-104																															
SCADAs Addresses																															
IP_client 1				255.255.255.255								IP_client 2				255.255.255.255															
IP_client 3				255.255.255.255								IP_client 4				255.255.255.255															
IP_client 5				255.255.255.255								IP_client 6				255.255.255.255															
IP_client 7				255.255.255.255								IP_client 8				255.255.255.255															
General protocol parameters																															
Common address of ASDUs								1				TCP/IP Port								2404											
Interoperability (Transmission)																															
Frame Length (max)								253				K				12				W				8							
								T1				60 s				T2				20 s				T3				120 s			
Interoperability (Application)																															
Measured value				Adjusted v				End of init. Transmission				☒																			
Use SNTP clock				☐				Clock validity				3600 s																			
Command type				Direct v				Command timeout				5 s				Select Timeout				10 s											
Single-point dating				☒				Double-point dating				☒				Integrated totals dating				☒											
Measured value dating				☒				Cyclic measured value dating				☒																			

■Protocol 60 870-5-104 Configuration page

Paragraph	Parameter	Configuration limits	Default Configuration	Comments
SCADAs Addresses (T200 only)	IP_client1 à IP_client8	0.0.0.0 to 255.255.255.255	255.255.255.255	The product allowed until 8 redundancy connections. Incoming addresses can be filtered 0.0.0.0 means that no incoming connections are allowed. 255.255.255.255 means that all incoming connections are allowed.
General protocol parameters	Common ASDU Address	1 to 65534	1	The equipment has a unique database for the all variables (only one ASDU address)
	TCP/IP Port	1 to 65534	2404	IEC 870-5-104 standard specifies that the number must be 2404. It is here configurable to be able to use any TCP/IP network.
Interoperability (Transmission)	Frame Length (max)	4 to 253	253	Maximum length of APDU (Application Protocol Data Unit)
	K	1 to 20	12	Number of frame that the unit can send without receiving acknowledged from the Supervisor.
	W	1 to 20	8	Number of frames that the unit can receive without sending acknowledgement. ($W < 2/3K$)
	T1	1 to 255	60 s	Maximum time to wait until the Supervisor indicates that it has correctly received the frame previously send by the unit. If the confirmation is not received, the session is closed.
	T2	1 to 255	20 s	Maximum time to wait before to send a S frame confirmation for frames received from the Supervisor. ($T2 < T1$)
	T3	1 to 255	120 s	If no data transfers occur during a certain period of time, a frame will be send to test the link. ($T3 > T1$)
Interoperability (Application)	Measured value	Adjusted or Normalized or Floating	Adjusted	Define measured value format to the SCADA
	End of init Transmission	Yes or No	Yes	Send or not a frame type M_EI_NA_1 once the communication is established with the SCADA
	Use SNTP clock validity	Yes or No	No	For signalization with time tag, the validity / invalidity of the dating can be given by SNTP synchronization by checking the option.
	Clock validity	0 to 86400 s	3600 s	Activation delay of the « clock validity » bit in CP56Time2a format after a synchronization made by the protocol 60870-5-104. 0 correspond to an 'always valid' clock.
	Command type	Direct or Selection and execution	Direct	Command by the protocol mode
	Command timeout	1 to 60 s	5 s	In case of command with time (C_SC_TA_1 or C_DC_TA_1), define the validity delay of the command compare to the frame date and time
	Select Timeout	0 to 60 s	5 s	In Selection and execution mode, define the maximum delay between the selection frame and the execution frame 0 correspond to an infinite delay
	Single-point dating	Yes or No	Yes	Specify if spontaneous single-points events must be time-stamped or not.
	Double-point dating	Yes or No	Yes	Specify if spontaneous double-points events must be time-stamped or not.

	Integrated totals dating	Yes or No	Yes	Specify if spontaneous integrated totals events must be time-stamped or not.
	Measured value dating	Yes or No	Yes	Specify if spontaneous measured value events (threshold, dead band) must be time-stamped or not.
	Cyclic Measured value dating	Yes or No	Yes	Specify if cyclic measured value events must be time-stamped or not.

R200-ATS100 Configuration

Settings

Device

Variables

Classes

☒ Synoptic view

Single line

Signals

☒ SCADA communication

Protocol

Ethernet port

Serial port

The protocol configuration can be found under Settings \ SCADA communication \ Protocol.

The parameters are similar to T200/F200C, and described in previous paragraph.

Protocol Parameters IEC 60870-5-104

General protocol parameters

Common address of ASDUs

1

Interoperability (Transmission)

Frame Length (max)

253

K

12

W

8

T1 (x1s)

60

T2 (x1s)

20

T3 (x1s)

120

Interoperability (Application)

Measured value

Normalized

End of init. Transmission

Yes

Clock validity (x1s)

3600

Command type

Select before execute

Command with time validity

5

Select Timeout

5

Single-point dating

Yes

Double-point dating

Yes

Integrated totals dating

Yes

Measured value dating

Yes

Cyclic measured value dating

Yes

Save

Cancel

- TCP port configuration:

The TCP server port can be modified under Settings \ SCADA communication \ Ethernet Port

TCP Port Parameters IEC 60870-5-104

General protocol parameters

TCP/IP Port

2404

Communication parameters on TCP/IP ports

Protocol

IEC 60870-5-104

Link

Normal

Save

Cancel

2.4. Bibliography

IEC101 Standard

The international standard has been specified by the International Electro technical Commission mainly in following documents:

- IEC 60870-5-1: 1990, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 1: Transmission frame formats*
- IEC 60870-5-2: 1992, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 2: Link transmission procedures*
- IEC 60870-5-3: 1992, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 3: General structure of application data*
- IEC 60870-5-4: 1993, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 4: Definition and coding of application information element*
- IEC 60870-5-5: 1993, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 5: Basic application functions*
- IEC 60870-5-101: 2003, *Telecontrol equipment and systems – Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks*
- IEC 60870-5-104: 2000, *Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles*

Previous documents use references to others useful documents with the following references :

- IEC 60050(371): 1984, *International Electro technical Vocabulary (IEV) – Chapter 371: Telecontrol*
 - IEC 60870-1-1: 1988, *Telecontrol equipment and systems – Part 1: General considerations – Section 1: General principles*
 - IEC 60870-5-103: 1997, *Telecontrol equipment and systems – Part 5-103: Transmission protocols – Companion standard for the informative interface of protection equipment*
 - OSI/IEC 8824-1: 2000, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*
 - ITU-T V.24: 2000, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)*
 - ITU-T V.28: 1993, *Electrical characteristics for unbalanced double-current interchange circuits*
 - ITU-T X.24: 1988, *List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) on public data networks*
 - ITU-T X.27: 1996, *Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s*
 - IEEE 754: 1985, *Binary floating-point arithmetic*
-

3. Object addressing

The table of information object addresses for IEC 870-5-104 protocol is exactly the same as the one of the IEC 870-5-101 protocol.

For the full list of these table addresses, consult the IEC 870-5-101 protocol user's manual (ref. NT00156-EN-xx).

[illegible]

[illegible]

Schneider Electric Industries SAS

Schneider Electric Telecontrol
839 chemin des Batterses
Z.I. Ouest
01700 St Maurice de Beynost
Tel : +33 (0)4 78 55 13 13
Fax : +33 (0)4 78 55 50 00

<http://www.schneider-electric.com>
E-mail : telecontrol@schneider-electric.com

*As standards, specifications and designs change from time to time,
please ask for confirmation of the information given in this publication.*