REC 501
RP 570 Protocol Description

Technical Description Manual

ABB

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Contents

Protocol RP 570

The RP 570 protocol is a high-level communication protocol used between the front-end computer (FE) and the substation to be controlled. The protocol is based on the low-level protocol recommended by IEC TC57, format class 1.2. The designation RP 570 is an abbreviation of "RTU Protocol based on IEC 57 part 5-1 (present IEC 870) version 0 or 1. The RP 571 protocol is an extension of RP 570 and intended to be used in gateway-type devices. The RP 570 protocol is a standard protocol generally used by ABB in one-level networks (Figure 1).

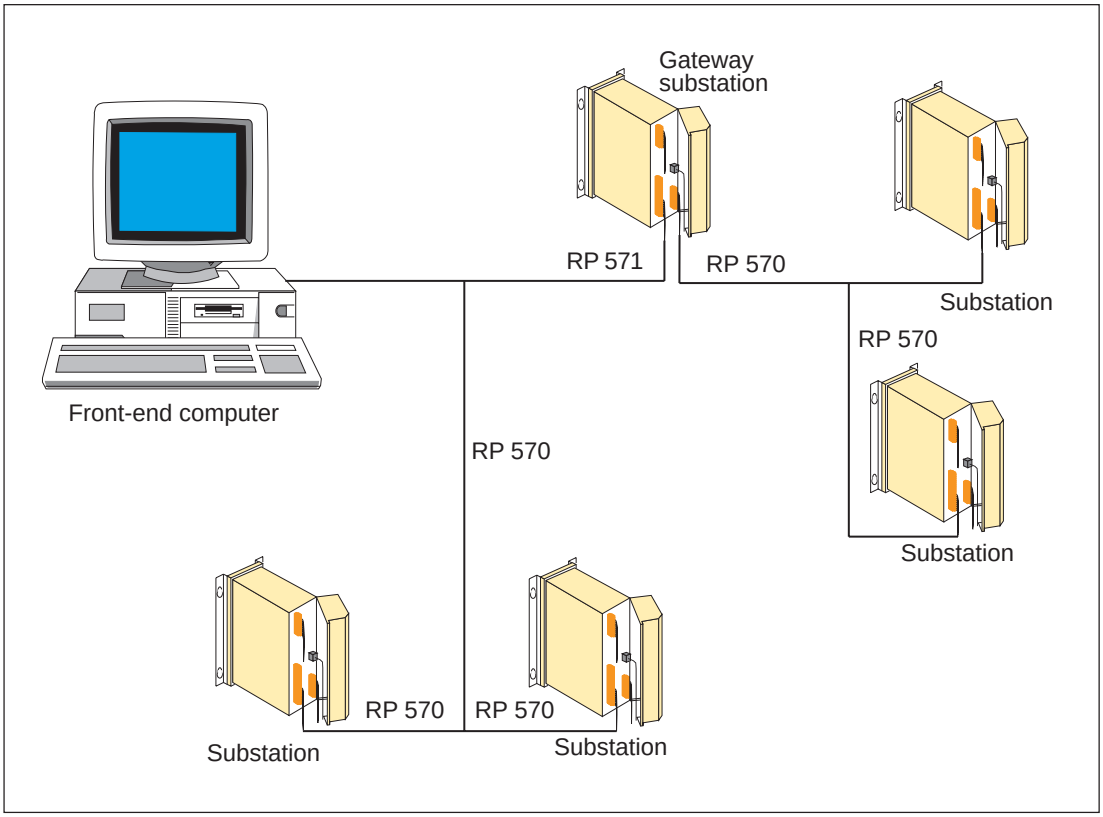

Figure 1. Network hierarchy according to RP 570 and RP 571 protocol specifications.

Compared to the ISO/OSI reference model the RP 570 protocol fulfills the layer division of a stripped three-layer stack model as follows:

RP 570	ISO/OSI
Physical layer	Layer 1, physical layer
Link layer	Layers 2 - 4, data link, network and transport layer
Application layer	Layers 5 - 7, session, presentation and application layer

The other software of the device operates on the so called user layer located above the three-layer model. The purpose of the protocol is to offer communication services for this layer.

The lowest protocol levels

The link layer determines the bit-level parameters. The protocol is an asynchronous protocol, in which the message is transmitted one byte at a time. The byte is specified as follows:
- start bit
- data bits
- parity bit, even parity
- stop bit
- in total 11 bits.

The frame structure defined by IEC is used above the bit level. The frame consists of either a fixed or a variable number of bytes. There are two start characters: a decimal 16 for frames of fixed length and a decimal 104 for frames of variable length (Figures 2 and 3).

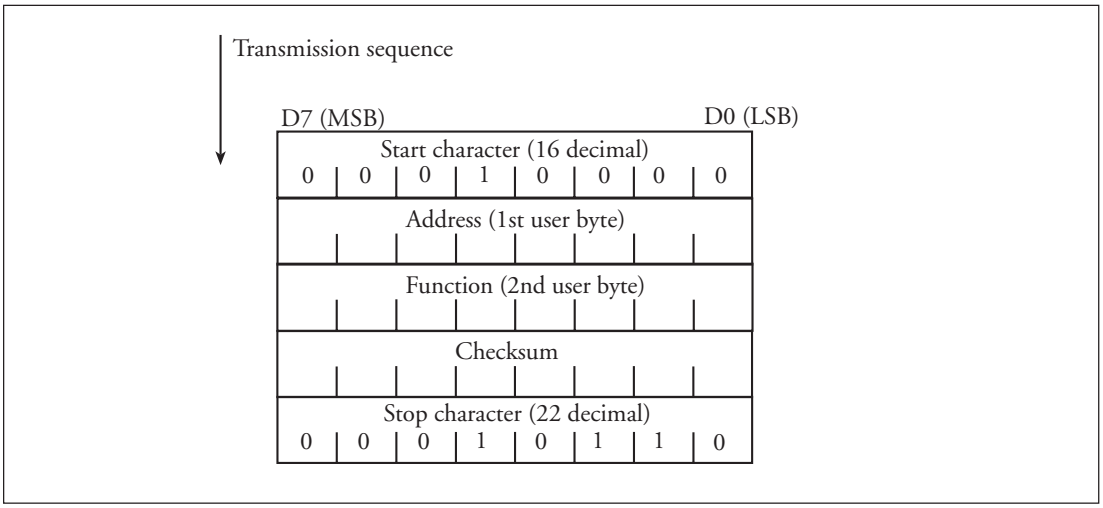

Fig. 2: Frame of fixed length

When a frame of fixed length is used, both the sender and the receiver know the length of the message. The frame contains two data octets, the address and a function code byte. Simple commands and acknowledgements, which do not contain real data, are of fixed length.

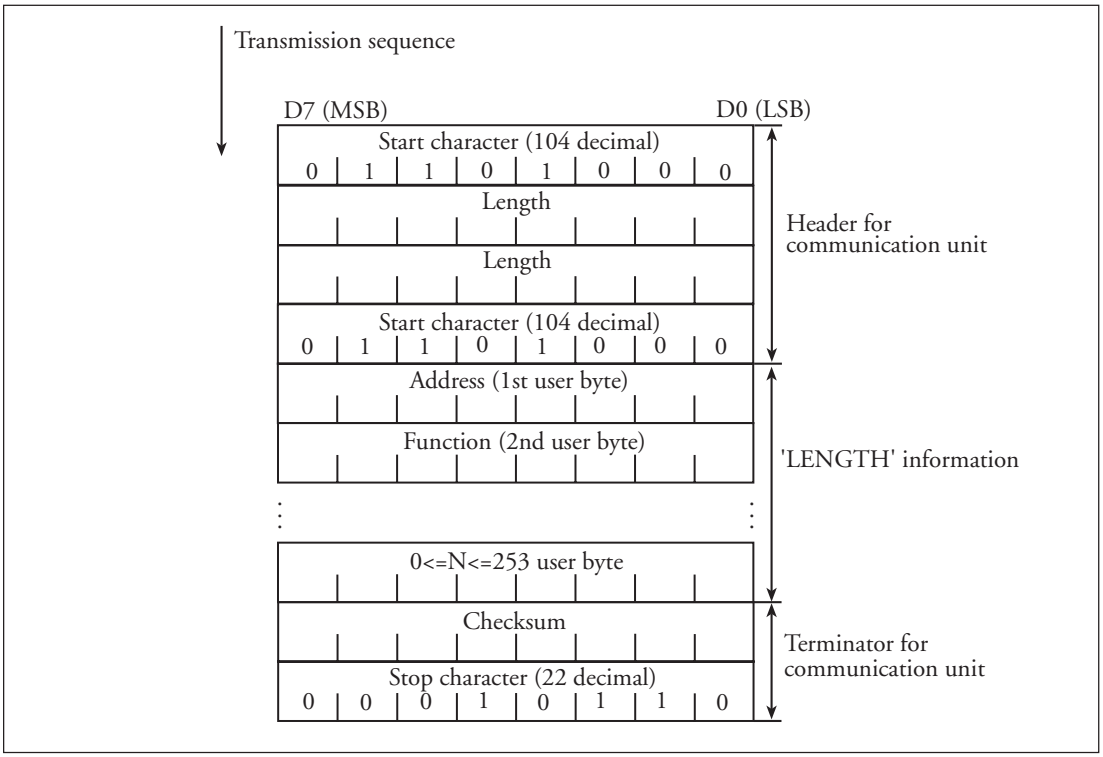

Fig. 3: Frame of variable length

A frame of variable length contains 2 - 255 data octets. The double length field of the frame header indicates the length of the data part. The address and the function code at the beginning of the data part identify the message.

The receiver of the message is identified by the address, which has to be unambiguous and in the range from 1 to 255. The address zero is a special case recognized by each device in the network. The device does not respond to a zero-address message received.

The function octet depends on the message direction. The task of the octet is to provide information about the type of message concerned. (Tables 1, 2 and 3). In addition, the byte contains encoded information defining the message.

Function code	Command	Explanation of command
XX100001	RA (Request A)	Request of priority level 1
XXX00011	SPM (Set Point Message)	Process value setting
XX100101	FTAB (Function TABle)	Parameterization of substation
XXX00111	IHC (InHibit Command)	Cancellation of command preselection
XX101001	RX (Request X)	Request for specific process value
XX101011	CBXC (Check Back before eXecute Command)	Preselection of 2-step command
XXX01101	FCOM (Function COMmand)	Control of internal substation functions
XXX01111	RSEQ (Reset SEQuence)	Resetting of sequence number
XX110001	RB (Request B)	Request of priority level 2
XXX10011	IXC (Immediate eXecute Command)	Command to be immediately executed
XXX10111	GOM (General Output Message)	General command for setting a process value
XXX11001	TSI (Time Sync Instruction)	Time synchronization
XX111011	EXC (EXecute Command)	Execution of 2-step command
XXX11101	TDC (Transparent Data in Command Direction)	Transmission of transparent message
XXX11111	SCI (Status Check Instruction)	Instruction for return of all data from substation, i.e. status/data check

Table 1: Function code in message direction FE - substation

Function code	Response message	Explanation of command
00000000	CCR1 (Cycle Complete Response, priority level 1)	Sequence termination, highest priority
00000010	CCR2 (Cycle Complete Response, priority level 2)	Sequence termination, lower priorities
00000100	EXRR (EXecute Response Restarted)	First message after restart
00000110	EXR (EXecuted Response)	Positive acknowledgement
00001000	NXR (Not eXecuted Response)	Negative acknowledgement
00001010	TSTA (Terminal STAtus message)	Internal status of a device
00001110	TEV (Terminal EVent message)	Change in internal status of a device
00010100	CBR (Check Back Response)	Command preselection accepted
00010110	SYSM (SYstem Message)	Return of internal substation fault codes
00011000	PRI (Polling Request Instruction)	Polling start request using dial-up line
00011100	TDR (Transparent Data in Response direction)	Transfer of message transparent to protocol
00101000	AVM 12 bit P1 (Analogue Value Message)	Analogue value of high priority
00101010	AVM 12 bit P2, P3 (Analogue Value Message)	Analogue value of lower priority data P2, P3
00101100	AVS P1 (Analogue Value with Status)	High-priority analogue value with status information
00101110	AVS P2, P3 (Analogue Value with Status)	Lower-priority analogue value with status information
00110000	IDM P1 (InDication Message)	Indication data of high priority
00110010	IDM P2, P3 (InDication Message)	Indication data of lower priorities
00110100	IDS P1 (InDication message with Status)	High-priority indication data with status information
00110110	IDS P2, P3 (InDication message with Status)	Lower-priority indication data with status information
00111000	DVM P1 (Digital Value Message)	Digital value of high priority
00111010	DVM P2, P3 (Digital Value Message)	Digital value of lower priorities
00111100	PCM P1 (Pulse Counter Message)	High-priority pulse counter value
00111110	PCM P2, P3 (Pulse Counter Message)	Lower-priority pulse counter value

Table 2: Function code in message direction substation - FE

Function code	Response message	Explanation of command
01000000	ERMI (Event Recording Message for Instructions)	Time-tagged status data
01000010	ERMA (Event Recording Message for Analogue measured values)	Limit violation of analogue value, with time tagging
10000000	AVM, 12-bit, incl. CCR1	High-priority analogue value combined for sequence termination (only if RA)
10000010	AVM, 12-bit, incl. CCR2	Lower-priority analogue value combined for sequence termination
10000100	AVS, incl. CCR2	High-priority analogue value with status information, combined for sequence termination (only if RA)
10000110	AVS, incl. CCR2	Lower-priority analogue value with status information, combined for sequence termination
10001000	IDM, incl. CCR1	High-priority indication data, combined for sequence termination (only if RA)
10001010	IDM, incl. CCR2	Lower-priority indication data, combined for sequence termination
10001100	IDS, incl. CCR1	High-priority indication data with status information, combined for sequence termination (only if RA)
10001110	IDS, incl. CCR2	Lower-priority indication data with status information, combined for sequence termination
10010000	DVM, incl. CCR1	High-priority digital value combined for sequence termination (only if RA)
10010010	DVM, incl. CCR2	Lower-priority digital value combined for sequence termination
10010100	PCM, incl. CCR1	High-priority pulse counter value combined for sequence termination (only if RA)
10010110	PCM, incl. CCR2	Lower-priority pulse counter value combined for sequence termination

Table 3: Function code in message direction substation - FE

In the message direction FE - substation the type of message is indicated with the D1 - D4 (F0 - F3) bits (Fig. 4, Table 1). The D0 bit is always one. Bit D5 (M/D) is a monologue/dialogue bit indicating whether the master device wants its message to be responded to or not. In general, the message is in the dialogue mode. When the FE wants to send the same message to all substations at the same time, it uses the monologue mode. Then the substation address is zero.

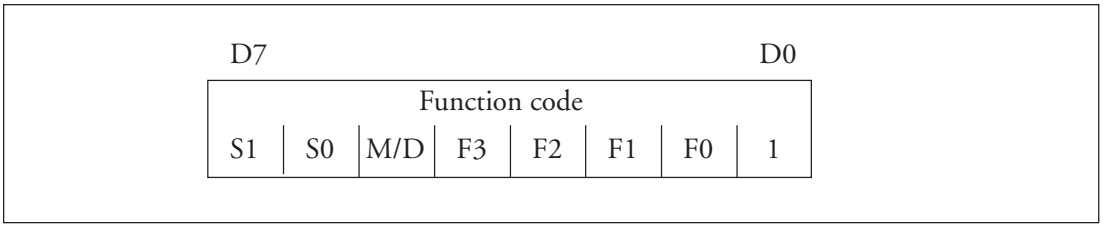

Fig. 4: Function code octet in message direction FE - substation

The D6 and D7 bits (S1, S0) indicate the sequence number. For dialogue-mode messages the sequence runs in the number order 0, 1, 2, 3, 0, 1, 2,... and the substation verifies that the next number of the sequence of the request message is in order. Should the sequence number be another than that expected, the substation repeats the last message it sent with the concerned sequence. For certain messages, the sequence can start from the beginning. In the monologue mode the sequence number is unimportant.

In the message direction substation - FE the whole octet length is used for identifying the message (Fig. 5, Tables 2 and 3), except for the D0 bit, which is constantly zero. The table length is primarily increased by the fact that the same message appears twice according to the priority level (priority in the table: P1, P2 and P3). Secondly, if the device has no new message to send after the present message, it can add the sequence-ending CCR1 or CCR2 character to the message. The message checksum is calculated as an arithmetic sum over the data part. Overflow is not considered in the calculation. Irrespective of the type of message, a message always ends with the end character 22 (decimal).

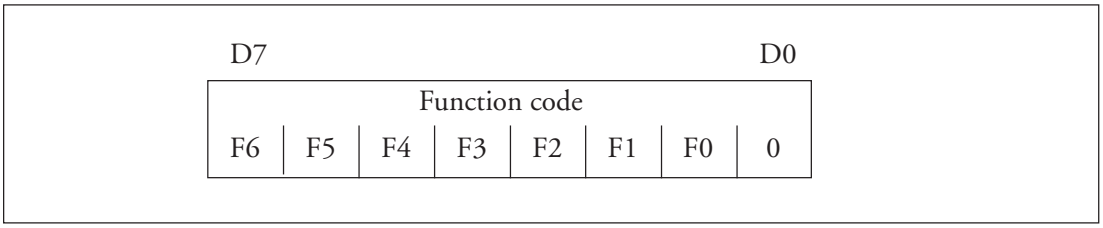

Fig. 5: Function octet in message direction substation - FE.

Messages

Above the messages to be used in the protocol have been presented in connection with the frame structure (Tables1, 2 and 3). In the protocol, the messages from the FE to the substation are grouped as
- RTU messages
- data request messages
- process commands.

The messages in the direction substation - FE are divided into the groups
- process data messages
- time-tagged event messages
- response messages
- status messages
- special messages.

Messages in direction FE - substation

The RTU message group includes a number of special messages for the control of the substation itself.

- SCI, Status Check Instruction, is sent to the substation when
  - the FE wants to start polling the substation
  - the substation does not respond to the polling
  - the FE wants all possible information from the substation.

  After restart, the substation approves no other message. The SCI sets the sequence number to zero and so the first request message has the sequence number one. If the substation stops operating, and the communication with the FE is interrupted, the FE starts polling the concerned substation for status information with repeated SCI messages. The SCI can be received frequently, if there are disturbances on the channel and messages are lost.

- RSEQ, Reset SEQuence number is a message to be used in test situations. This message forces the sequence to start from the beginning. The message arrives with the sequence number zero and the next message with the sequence number one.
- FCOM, The Function COMmand message, is used for controlling the station itself. The substation incorporates a lot of functions, for instance, restart of the station, which can be commanded by this message.
- FTAB, Function TABle, is intended to be used for parameterizing the substation. There is a great number of tables which include very detailed parameters for handling various process variables. All tables are sent with the same function code and they are identified with a special subcode.
- TSI, Time Synchronization Instruction, synchronizes the calender time of the substation with the FE time. The handling time has to be compensated for in the substation by recording the local time when the receipt of the message is started and adding it to the calender time.

Via data request messages the master requests the substation to send the new values of the process points that have changed.

- RA, Request A, is the request message of the highest priority. The response to the message contains process data of the highest priority alone.
- RB, Request B, is a normal request message used to poll the substation for new process data.
- RX, Request X, the message refers to one process value.

Process commands are used to instruct the substation to perform a specific action, which typically relates to the process to be controlled.

- IXC, Immediate eXecute Command, is sent to the substation, when the FE wants the command to be executed at once.
- CBXC, Check Back before eXecute Command, is the preselection of a command. In a two-step command the object is first selected (step one) and then the command is executed (step two).
- EXC, EXecute Command, executes a given command in the preselected object. If no object has been preselected, the command will not be executed.
- IHC, InHibit Command, allows the preselected command to be cancelled.
- SPM, Set Point Message, sets the setting value for the process value. The setting value can be digital or analogue.
- GOM, General Output Message, is a general command used for setting a digital or analogue object relating to the process.
- TDC, Transparent Data in Command Direction, transmits a transparent message to the substation. This message may be a message of another protocol, encapsulated in the data part of the RP 570 protocol.

Messages in direction substation - FE

With process data messages the substation communicates the new values of changed process data.

- IDM, InDication Message. One- and two-bit status information can be packed as 16-bit blocks in the message.
- IDS, InDication message with Status. One- and two-bit status information can be packed as 16-bit blocks in the message. In addition, the message contains status information about each bit. Status value one indicates that the status data is faulty or out of use.
- AVM, Analogue Value Message, includes one or more analogue values.
- AVS, Analogue Value message with Status, includes one or more analogue values. In addition, the message includes status information of each data element, block.
- DVM, Digital Value Message, includes one digital value.
- DVS, Digital Value message with Status, includes one digital value. In addition, the message includes status information of the data element, block.
- PCM, Pulse Counter Message, contains the value of one pulse counter, and, in addition status data and other counter-related information.
- TDR, Transparent Data in Response direction, is sent to the FE, when the substation wants to send general information to it, typically, a message in response to a TDC message. The message content is transparent to the protocol.

Time-tagged event messages forward time-tagged information about changes in process data. The messages are replies to the request messages RA and RB.

- ERMI, Event Recording Message for Indication, transfers one time-tagged one- or two-bit status data item after the change of a value. The message contains the new value.
- ERMA, Event Recording Message for Analogue value, contains time-tagged information about exceeding of an analogue process data limit value.
- ERMD, Event Recording Message for Digital value, contains time-tagged information about exceeding of a digital process data limit value.

By response messages the substation communicates that it has received and accepted the message sent.

- CCR1, Cycle Complete Response of priority 1. The message is sent as a response to the FE, when the substation no longer has any messages of the highest priority level. The polling sequence ends with this message.
- CCR2, Cycle Complete Response of Priority 2, is sent as a response to the FE, when the substation has no more changed process point values on levels below the highest priority level. A polling sequence ends with this message.
- EXR, EXecuted Response, is given as an indication of positive acknowledgement.
- EXRR, EXecuted Response - Restarted, is an acknowledgement of the first SCI message received after restart.
- NXR, Not eXecuted Response, is a negative acknowledgement.
- CBR, Check Back Response, is sent in response to an accepted preselection made by the FE. The message contains an identification of the command object.

The most important status messages are TSTA and TEV.

- TSTA, Terminal STAtus. This message is sent by the substation in response to an RA/RB request. The message may contain information about 16 internal status indications.
- TEV, Terminal EVent, is also sent in response to an RA/RB request. By this message the substation reports on a change in the internal status of a device.

The group of special messages includes one message:

- PRI, Polling Request Instruction. This message is used when the device is connected to a public switched telephone network. The substation dials up the FE, when it has reason to communicate. Once the line is open the substation sends the PRI message without a preceding RA or RB request message. The FE identifies the calling substation by this message

Address space

Data to be read from the device is called blocks and data to be written to the device is called objects. Each message type has its own address space, the size of which, with the exception of the command object space, can be in the range 1...255 (Table 3: Address spaces). It should be observed that the address space starts from the address one and not from zero as in C language indexing.

Type of message	Format	Possible address space	
IDM	16 bits	1…255	indication
AVM	12 bits	1…255	analogue value
DVM	16 bits	1…255	digital value
PCM	32 bits	1…255	pulse counter
CBX	1 bit	1…2048	control
SPM	digital value 15 bits analogue value 12 bits	1…255	setting value
GOM	digital value 1, 2 or 15 bits analogue value 12 bits	1…255	general setting

Table 3: Address spaces

The highest protocol layers

Some rules for the operation of the protocol on the application layer have been specified for the highest layers of the RP 570 protocol. The procedures for retransmission of messages, priority handling and polling have been separately specified.

Retransmission of messages

A message can be destroyed in the transmission channel so that it does not pass the check in the FE end or the substation end. Then the FE goes on requesting retransmission of the message, until the message arrives correctly or the maximum limit for retransmissions is reached. If all the messages received from the substation have been false, the substation is assumed to be out of operation. In the monologue mode, on the other hand, the FE does not necessarily notice that the message was not correctly received by the substation.

The sequence number described before is used for the control of retransmissions (Fig. 4).

If the FE does not receive a message that passes its checks, it repeats, with the same sequence number the last message sent, until the repetition limiter trips. After this the substation concerned is assumed to be out of use and the FE starts sending SCI messages to the substation. No other messages are sent to a substation being out of use.

The substation stores the function byte of the last four messages correctly received, together with the sequence number and the whole message sent. The substation may receive a message in which the sequence number does not follow the sequence 0, 1, 2, 3, 0, 1, 2… . In such a case the substation checks whether the same function byte has been stored with the sequence number of the received message and, if so, the stored message will be sent. The action requested in the message will not be repeated.

If the substation receives a message that forces the sequence to zero, i.e. an SCI or RSEQ message - it destroys all the messages and function bytes stored. However, such event-type messages, which cannot be regenerated from e.g. the database have to be sent. Typically such messages are TEV, SYSM, ERMI and ERMA.

Priority levels

The process data messages from the substation to the FE are identified by the type and the block number of the message. Each message is of a specific priority level: P1, P2 or P3. P1 is the highest priority level. The priority of the messages IDM, IDS, AVM, AVS, DVM and PCM is indicated by the function byte of the message (Fig. 4, Table 2 and 3). A priority defining field for the messages TDR, ERMI, ERMA, TSTA, TEV and SYSM has not been separately specified.

The priority has been specified for each process data item. Messages sent in response to request message, i.e. IDM, IDS, AVM, AVS, DVM or PCM, are generated according to priority. TSTA and TEV messages are high-priority messages and always of priority level P1. ERMI, ERMA and TDR messages contain less important data and are of priority level P2. SYSM messages are of priority level P3. The FE uses priority data and CCR1 and CCR2 response messages to specify the type of the next request message to be sent. On the basis of the same information it also decides which substation has to be polled next.

Once the substation receives an RA or RB request message it has to check the station data and return a response message. This response message includes the process point value of the right process level, provided the value has changed. Only process points of priority level P1 are used to respond to an RA request message (Fig. 6), whereas messages of any priority level can be sent in response to an RB request message. (Fig. 7). A value that has already been sent after a CCR1 or CCR2 message was sent must not be used in reply to a request message. Of messages which always have a defined priority cannot be sent but one between CCR1 and CCR2 messages.

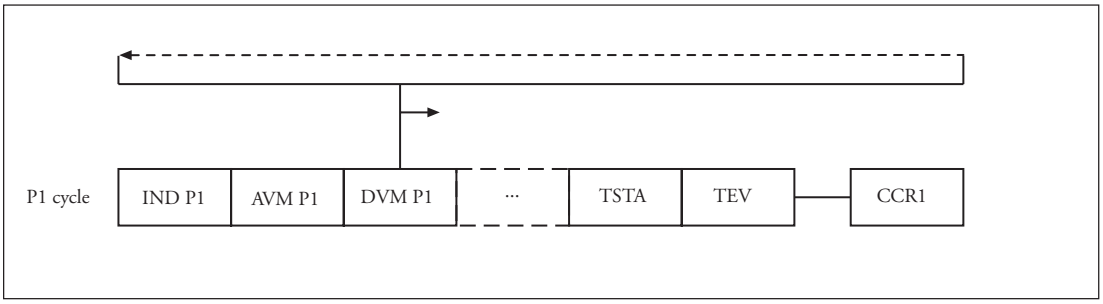

Fig. 6: Example of RA sequence

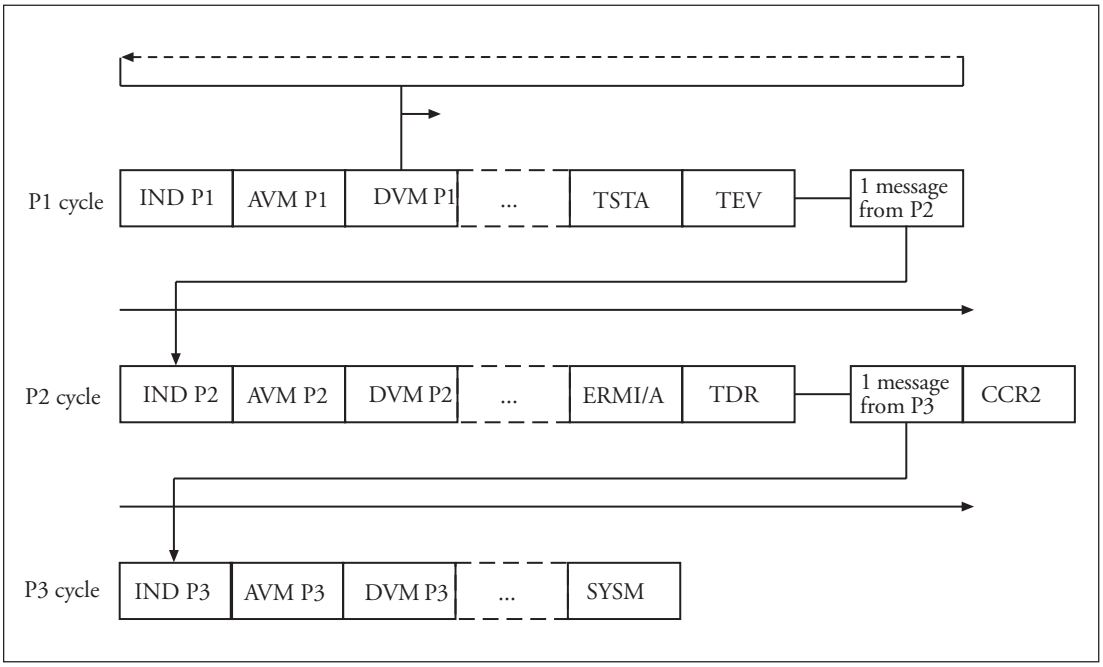

Fig. 7. Example of RB sequence

Polling principle

The main principle of polling is that only data that has changed since the previous poll is transmitted from the substation. The FE uses a specific method of using RA and RB request messages and controlling a number of substations. The substation knows nothing but how the priority levels behave and how to respond to RA and RB request messages.

RA sequence

The RA sequence is a set of messages between CCR1 messages. The substation responds to an RA request message with one process data message of priority level P1. The process point must not be sent but once during a sequence. One TSTA and one TEV message alone may be sent during a sequence. The sequence has to be terminated by sending a CCR1 message or adding the CCR1 data to the process data message (Fig. 6).

RB sequence

The RB sequence is a set of messages between CCR2 messages. The substation responds to an RB request message with a process data message of any priority level. The process point cannot be sent in the process data message but once during a sequence. All the messages of priority level P1 and one from the next level are returned during the sequence. The sequence is terminated:

- by sending a CCR2 message
- by including CCR2 data in the process data message
- automatically when one message of priority level P2 or P3 has been sent.

During the following sequence all the messages of the highest priority level have to be given, provided that some of the values have changed, and one message from one of the lower-priority levels. It is permitted to send just one ERMI, ERMA or TDR message from the P2 level. It is also possible to send just one message from level P3, if higher-level messages already were sent. Only one SYSM message is permitted during a sequence. During an RB sequence no CCR1 message can be sent (Fig. 7).

Command messages

The FE can send a command message to the substation between any request messages. Actions related to these have to be performed irrespective of polling sequence.

For request messages the FE uses a special method trying to collect as quickly as possible the most important information from all substations. The substation has to be ready to receive any of the request messages, however, so that the sequence is completed first.

Input Messages

RP 570 protocol of REC 501 accepts following input messages:

Command	Meaning	Notes
RA	Request A.	Polls priority 1 blocks
RB	Request B	Polls all blocks
IXC	Immediate eXecute Command	Just for Reset module status, C. Block 5 of CBX type addresses
CBXC	Check Back before eXecute Command	Open/close select objects, V1-V2. Blocks 1 and 2 of CBX type addresses
EXC	EXecute Command	Execute selected open/close object, V3. Blocks 1 and 2 of CBX type addresses
IHC	InHibit Command	Inhibit selected open/close object, V3. Blocks 1 and 2 of CBX type addresses
SPM	Setpoint Message	Object range 1-5 used
GOM	General Output Message	Object range 1-11 used
SCI	Status Check Instruction	
RSEQ	Reset SEQuence number	
TSI	Time Sync Instruction	
FCOM	Function COMmand	Only Function Command Number 1 and 4 accepted. 1 - Cold start 4 - Generate event message with PROM version
FTAB	Function Table	Types - Basic Function Table, Indications NR 0x00 - Basic Function Table, Analogue Measured Value NR 0x0A, - Basic Function Table, Digital Value NR 0x14 - Basic Function Table, Pulse Counter NR 0x1E accepted. Fields Block NR, Priority and Blocked/Deblocked have a meaning, others are ignored.
TDC	Transparent Data in Command direction	Only message class 6 accepted, transparent SPA. SPA message bytes cannot exceed 30 bytes.

Table 5: Accepted Input Messages

Output Messages

RP 570 protocol of REC 501 uses following messages:

Command	Meaning	Notes
CCR1	Cycle Complete Response, priority level 1	Ends the poll cycle. Each block may be sent once in a cycle.
CCR2	Cycle Complete Response, priority level 2	Ends the poll cycle. Each block may be sent once in a cycle.
EXR	EXecuted Response	
EXRR	EXecuted Response, device Restarted	
NXR	Not eXecuted Response	
CBR	Check Back Response	
AVM	Analogue Value Message without status	
DVM	Digital Value Message without status	
PCM	Pulse Counter Message	
IDM	InDication Message without status	
TEV	Terminal EVent message	Only Event Numbers 1, 6 and 13 used. SPA event E50 causes event number 1 FCOM #4 causes event number 6 NXR response also causes TEV 13. One TEV per poll cycle
TSTA	Terminal STAtus message	Only TSTA ident 1 used. Bits D4, D7, D8, D9, D13, D14, D15 used. See Table 15.
TDR	Transparent Data in Response direction	Only message class 6 used, transparent SPA. SPA message bytes cannot exceed 252 bytes
PRI	Polling Request Instruction	Sent spontaneously without RA/RB poll, when the dial-up line is opened by REC 501 built-in modem (if PSTN line used).

Table 6: Outgoing messages used

Address Mapping of REC 501

The addresses for values to be read from the device are called blocks. Addresses for values to be written to the device are called objects.

The addresses are divided into four sub-areas. The data is arranged according to the data type so each message type has its own area. The following table collects possible message types, address ranges used and formats.

Data type	Format	Used address range	
IDM	16 bit	1…2	Indications
AVM	12 bit	1…4	Analogue values
DVM	16 bit	1…4	Digital values
PCM	32 bit	1…10	Pulse counters
CBX	1 bit	1…2, 5	Controls
SPM	digital 15 bit analogue 12 bit	1…5	Setpoints
GOM	digital 1, 2, 15 bit analogue 12 bit	1…11	General outputs

Table 7: Address Map

Data items type IDM, AVM, DVM and PCM are used for process data read from the device. The value is sent to the master device as an acknowledge message of the poll. The CBX type is used for commands given by the operator and SPM and GOM for parameters.

Note that AVM 12 bit is 11 bit for value and highest bit for sign. Value range is -2048...2048.

IDM Type Addresses

Block	Bits in block	Priority	Relevant SPA event or parameter
1	0-1	1	Status of an object on channel 1 (value represents new 2-state status), I3
1	2-3	1	Status of an object on channel 2 (value represents new 2-state status), I3
1	8	1	Battery voltage, I11
1	9	1	Power supply temp, I9 (overHeat)
1	10	1	Aux. Supply, I10 (acFail)
1	11	1	Cumulative or wrap-around pulse counting on channel 1 (0=cumulative, 1=wrap), S12
1	12	1	Cumulative or wrap-around pulse counting on channel 2 (0=cumulative, 1=wrap), S12
1	13	1	Heating, I12
1	14	1	Local blocking in channel 1 (0=not blocked, 1=blocked)
1	15	1	Local blocking in channel 2 (0=not blocked, 1=blocked)
2	0	2	Input X2 (1/2) (0=not active, 1=active), I4
2	1	2	Input X2 (3/2) (0=not active, 1=active), I5
2	2	2	Input X2 (4/5) (0=not active, 1=active), I6
2	3	2	Input X2 (6/5) (0=not active, 1=active), I7
2	4	2	Input X2 (7/8) (0=not active, 1=active), I8

Table 8: IDM Type Addresses

Note:
If any of the inputs I3, I4, I5 is connected to operate as pulse counters, the application SW will mask the input.

AVM Type Addresses

Block	Bits in block	Priority	Threshold (note 1)	Relevant SPA parameter
1	0-12	2	5, V237	Temperature within enclosure, I1
2	0-12	1	10, V238	Battery charging voltage, I2
3	0-12	2	10, V238	Minimum battery voltage, V6
4	0-12	2	-	Delta for sending battery charging voltage, V238

Table 9: AVM Type Addresses

General note:
No scaling; always use 1 for block 1 and 10 for blocks 2 - 4.

Note 1:
Threshold: delta for new value. If the change is smaller, nothing will be transferred.

DVM Type Addresses

Block	Bits in block	Priority	Relevant SPA parameter
1	0-7	2	Event mask for inputs, V155
1	8-15	2	Event mask for inputs, V156
2	0-7	2	Event mask for counters, V157
2	8-15	2	Event mask for outputs, V158
3	0-5	2	Event mask for open/close channel 1, V159
3	8-13	2	Event mask for open/close channel 2, V159
4	0-7	2	Delta for sending enclosure temperature, V237
4	8-15	2	Modem diagnostic interval, V224

Table 10: DVM Type Addresses

PCM Type Addresses

Block	Priority	Relevant SPA parameter
1	2	Operation counter, channel 1, V5
2	2	Operation counter, channel 2, V5
3	2	Intermediate counter, channel 1, V11
4	2	Intermediate counter, channel 2, V11
5	3	Periodic counter 1, channel 1, V20
6	3	Periodic counter 1, channel 2, V20
7	3	Periodic counter 2, channel 1, V22
8	3	Periodic counter 2, channel 2, V22
9	3	Periodic counter 3, channel 1, V24
10	3	Periodic counter 3, channel 2, V24

Table 11: PCM Type Addresses

Note:
Blocks 5 - 10 will not be reported to the network controller in response to a polling message on normal sequence. They are reported only when requested by interrogation command SCI.

GOM Type Addresses

Object	Relevant SPA parameter and notes
1	Reset minimum battery voltage, V7 (only binary 1 accepted)
2	Reset pulse counter values on channel 1, V9 (only binary 1 accepted)
3	Reset pulse counter values on channel 2, V9 (only binary 1 accepted)
4	Cumulative or wrap-around pulse counting on channel 1, S12 (0=wrap, 1=cumulative)
5	Cumulative or wrap-around pulse counting on channel 2, S12 (0=wrap, 1=cumulative)
6	Event mask for inputs, V155
7	Event mask for inputs, V156
8	Event mask for counters, V157
9	Event mask for outputs, V158
10	Event mask for open/close on channel 1, V159
11	Event mask for open/close on channel 2, V159

Table 12: GOM Type Addresses

SPM Type Addresses

Object	Relevant SPA parameter and notes
1	Operation counter on channel 1, V5
2	Operation counter on channel 2, V5
3	Delta for sending enclosure temperature, V237
4	Delta for sending battery charging voltage, V238
5	Modem diagnostic interval, V224

Table 13: SPM Type Addresses

CBX Type Addresses

Object	Relevant SPA parameter and notes
1	Object on channel 1. Select, execute and inhibit. V1, V2, V3 and V4
2	Object on channel 2. Select, execute and inhibit. V1, V2, V3 and V4
5	Reset module status, C (IXC) (note 1)

Table 14: CBX Type Addresses

Note 1:
To be done via Event Handler. Clear event buffers E50, E51 (and the rest, too).

TSTA Message Content

Ident 1 is partly used by REC 501.

Ident	Bit	Bit meaning and relevant SPA parameter
1	4	1 = At least one output relay is faulty; V169
1	7	1 = REC 501 is faulty. Checksum error in RAM, ROM or EEPROM; V169
1	8	1 = REC 501 is active. 0 = The unit has been subjected to automatic reset. Module status information, (note 1)
1	9	1 = REC 501 synchronised. At least one synchronisation message received (note 2)
1	13	1 = AC fail, REC 501 running on backup battery supply; I10 = 1
1	14	1 = Battery low; I11 = 1 (low)
1	15	1 = No printer. Bit always set to 1.

Table 15: Module Status Information

Note 1:
Module status information to be read via event handler, events E50.

Note 2:
REC 501 will always report "not synchronised" after disconnecting the SPA-configuration cable. This is because the RP 570 protocol will be initialised on a change.

TEV Message Content

REC 501 uses only events number 1, 6 and 13.

Event	Meaning	Additional info1 - info6
1	REC 501 restarted	-
6	Program version	info1 - info6 = program version identification. The whole version number is expressed as 1MRS11xxxxy, where 1MRS11 is fixed, xxxx is a four-digit number and y is the version letter. The last six characters, i.e. 1xxxxy are transferred .
13	Command failed	info1: 1 - object command 2 - not used 3 - set point command 4 - general output command info2 - info6: not used

Table 16: TEV message content.

FCOM Message Format

REC 501 allows the priority and blocking information of the AVM, IDM, DVM and PCM type process point to be changed.

The function table includes several fields, but only those mentioned below have a function in REC 501, others are ignored:
- FTAB type; identifies the table
- block; identifies the target block
- priority; new priority for target block, in range 1…3
- blocked; 1 if target block is to be blocked.

All data types are blocked by the target block, also the IDM type.

Communication Parameters

Data	Channel	Parameter	Data direction	Values	Default
Selection of active protocol (not valid at parameterization	0	V202	R,W	0 = SPA protocol 1 = remote protocol	0
Station address	0	V210	R,W	0…255	255
Data transfer rate	0	V211	R,W	0.3; 0.6; 1.2; 4.8; 9.6; or 14.4 kBd	1.2
CTS delay	0	V213	R,W	0…255 = 0…2550 ms	3
RTS keep up delay	0	V214	R,W	0…255 = 0…2550 ms	1
Delta for spontaneous sending of enclosure temperature	0	V237	R,W	1...10°	5°
Delta for spontaneous sending of battery charging voltage	0	V238	R,W	0.1...5.0 V dc	1.0 V dc

Table 17: Communication parameters

Configuration Example

The RP 570 protocol is to be used with a build-in modem. The REC 501 unit is to call the master once the temperature changes more than 4°C. Further more, there is one pulse counter input with a counting period of 1 hour, local remote switch, heating and one object to control.

Parameters to be set
- Remote communication parameters
- Modem communication parameters
- Functional parameters
- RP 570 application layer parameters

This configuration requires the following set-up:

V202 = 1 Remote protocol to be used.
V210 = 50 RP 570 device address 50.
V211 = 9.6 Communication speed 9600 Bd.
V220 = 1 Switched line in use.

V221 = ATV0X0E0S0=2
This sets the modem initialisation string. Refer to the modem manual.
V222 = ATH1d,1234567
This sets the dialling string. 1234567 is the phone number of the master station.
V223 = ~~~+++~~~ATH
Hang-up string.

S5 = 80 Default + input 4 pulse for counter.
S6 = 4 Input 5 is local / remote switch.
S8 = 8 Output 4 is heating.
1S11 = 60 Counting period 60 min.
V237 = 4 Delta for spontaneous sending of enclosure temperature 4°C.

All other settings are default values.

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