



Flow Computer

**Device Series enCore FC**

**MC1, FC1**

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**Interoperability List**  
**IEC60870 AFB**

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# 1 Time monitoring for coupling according to IEC 60870-5-104

Maximum range of all-time monitoring values: 1 to 255s, accuracy 1s

Maximum number k of unacknowledged APDU (application layer: APDU = APCI + ASDU) in i-format and latest acknowledgement.

Parameter	If no other value is specified	Comments	Selected value
t1	15s	Time monitoring for transmitted ASDU or test ASDU	15s
t2	10s	Time monitoring for acknowledgements if no data telegrams are transmitted t2 < t1	10s
t3	20s	Time monitoring for transmitted S telegrams in case of long resting states t3 < t1	20s

Maximum value range k: 1 to 32767 (215-1) DDU, accuracy 1 APDU

Maximum value range w: 1 to 32767 APDU, accuracy 1 APDU (recommended: w should not exceed 2/3 of k)

Parameter	If no other value is specified	Comments	Selected value
K	12 APDUs	Maximum difference between reception sequence number and sender sequence number	12
W	8 APDUs	Latest acknowledgement after receiving w APDU in I-format	8

## Port address

Parameter	If no other value is specified	Comments
Port address	2404	adjustable

## Redundant connections

Parameter	If no other value is specified	Comments
N	2	Number of redundant connections Note: At the moment up to 4 individual connections are provided.

## 2 Application layer

### 2.1 Transmission mode for application data

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

### 2.2 Common address of ASDU

- |                                     |          |                                     |              |
|-------------------------------------|----------|-------------------------------------|--------------|
| <input checked="" type="checkbox"/> | 1 octet  | <input checked="" type="checkbox"/> | structured   |
| <input checked="" type="checkbox"/> | 2 octets | <input checked="" type="checkbox"/> | unstructured |

### 2.3 Information object address

- |                                     |          |                                     |              |
|-------------------------------------|----------|-------------------------------------|--------------|
| <input checked="" type="checkbox"/> | 1 octet  | <input checked="" type="checkbox"/> | structured   |
| <input checked="" type="checkbox"/> | 2 octets | <input checked="" type="checkbox"/> | unstructured |
| <input checked="" type="checkbox"/> | 3 octets |                                     |              |

### 2.4 Cause of transmission

- |                                     |         |                                     |                                     |
|-------------------------------------|---------|-------------------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | 1 octet | <input checked="" type="checkbox"/> | 2 octets (with originator address). |
|-------------------------------------|---------|-------------------------------------|-------------------------------------|

### 2.5 Selection of standard ASDUs

#### Process information in monitor direction

- |                                     |      |   |
|-------------------------------------|------|---|
| <input checked="" type="checkbox"/> | <1>  | := Single-point information                       |
| <input type="checkbox"/>            | <2>  | := Single-point information with time tag         |
| <input checked="" type="checkbox"/> | <3>  | := Double-point information                       |
| <input type="checkbox"/>            | <4>  | := Double-point information with time tag         |
| <input type="checkbox"/>            | <5>  | := Step position information                      |
| <input type="checkbox"/>            | <6>  | := Step position information with time tag        |
| <input checked="" type="checkbox"/> | <7>  | := Bitstring of 32 bit                            |
| <input type="checkbox"/>            | <8>  | := Bitstring of 32 bit with time tag              |
| <input checked="" type="checkbox"/> | <9>  | := Measured value, normalized value               |
| <input type="checkbox"/>            | <10> | := Measured value, normalized value with time tag |
| <input type="checkbox"/>            | <11> | := Measured value, scaled value                   |

- <12> := Measured value, scaled value with time tag
- <13> := Measured value, short floating point value
- <14> := Measured value, short floating point value with time tag
- <15> := Integrated totals
- <16> := Integrated totals with time tag
- <17> := Event of protection equipment with time tag
- <18> := Packed start events of protection equipment with time tag
- <19> := Packed output circuit information of protection equipment with time tag
- <30> := Single-point information with time tag CP56Time2a
- <31> := Double-point information with time tag CP56Time2a
- <32> := Step position information with time tag CP56Time2a
- <33> := Bitstring of 32 bit with time tag CP56Time2a
- <34> := Measured value, normalized value with time tag CP56Time2a
- <35> := Measured value, scaled value with time tag CP56Time2a
- <36> := Measured value, short floating point value with time tag CP56Time2a
- <37> := Integrated totals with time tag CP56Time2a
- <38> := Event of protection equipment with time tag CP56Time2a
- <39> := Packed start events of protection equipment with time tag CP56Time2a
- <40> := Packed output circuit information of protection equipment with time tag CP56Time2a

#### Process information in control direction

- <45> := Single command
- <46> := Double command
- <47> := Regulating step command
- <48> := Set point command, normalized value
- <49> := Set point command, scaled value
- <50> := Set point command, short floating point value
- <51> := Bitstring of 32 bit
- <58> := Single command with time tag CP56Time2a
- <59> := Double command with time tag CP56Time2a
- <60> := Regulating step command with time tag CP56Time2a
- <61> := Set point command, normalized value with time tag CP56Time2a
- <62> := Set point command, scaled value with time tag CP56Time2a
- <63> := Set point command, short floating point value with time tag CP56Time2a
- <64> := Bitstring of 32 bit with time tag CP56Time2a

#### System information in monitor direction

- <70> := End of initialization

**System information in control direction**

- <100> := Interrogation command
- <101> := Counter interrogation command
- <102> := Read command
- <103> := Clock synchronization command
- <104> := Test command
- <105> := Reset process command
- <106> := Delay acquisition command
- <107> := Test command with time tag CP56Time2a

**Parameter in control direction**

- <110> := Parameter of measured value, normalized value
- <111> := Parameter of measured value, scaled value
- <112> := Parameter of measured value, short floating point value
- <113> := Parameter activation

**File transfer**

- <120> := File ready
- <121> := Section ready
- <122> := Call directory, select file, call file, call section
- <123> := Last section, last segment
- <124> := Ack file, ack section
- <125> := Segment
- <126> := Directory

## 2.6 Type identifier and cause of transmission assignments

ASDU		Cause of transmission																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	20, 21	37, 38	44	45	46	47
<1>	M_SP_NA_1			x		x									x					
<7>	M_BO_NA_1			x		x									x					
<9>	M_ME_NA_1			x		x									x					
<13>	M_ME_NC_1			x		x									x					
<15>	M_IT_NA_1			x												x				
<30>	M_SP_TB_1			x		x														
<33>	M_BO_TB_1			x		x														
<34>	M_ME_TD_1			x		x														
<36>	M_ME_TD_1			x		x														
<37>	M_IT_TB_1			x												x				
<45>	C_SC_NA_1						x	x									x	x	x	x
<48>	C_SE_NA_1						x	x									x	x	x	x
<50>	C_SE_NC_1						x	x									x	x	x	x
<51>	C_BO_NA_1						x	x									x	x	x	x
<58>	C_SC_TA_1						x	x									x	x	x	x
<61>	C_SE_TA_1						x	x									x	x	x	x
<63>	C_SE_TC_1						x	x									x	x	x	x
<64>	C_BO_TA_1						x	x									x	x	x	x
<70>	M_EI_NA_1*				x															
<100>	C_IC_NA_1						x	x			x						x	x	x	x
<101>	C_IC_NA_1						x	x			x						x	x	x	x
<102>	C_RD_NA_1					x											x	x	x	x
<104>	C_RP_NA_1						x	x									x	x	x	x
<105>	C_RP_NA_1						x	x									x	x	x	x
<107>	C_TS_TA_1						x	x									x	x	x	x
<120>	F_FR_NA_1														x		x	x	x	x
<121>	F_SR_NA_1														x		x	x	x	x
<122>	F_SC_NA_1						x								x		x	x	x	x
<123>	F_LS_NA_1														x		x	x	x	x
<124>	F_AF_NA_1														x		x	x	x	x
<125>	F_SG_NA_1														x		x	x	x	x
<126>	F_SG_NA_1														x		x	x	x	x



## 2.7 Basic application functions

### Station initialization

- initialization

### Station interrogation

- |   |                                   |                                   |
|---|-----------------------------------|-----------------------------------|
| <input checked="" type="checkbox"/> global  | <input type="checkbox"/> group 7  | <input type="checkbox"/> group 13 |
| <input checked="" type="checkbox"/> group 1 | <input type="checkbox"/> group 8  | <input type="checkbox"/> group 14 |
| <input type="checkbox"/> group 2            | <input type="checkbox"/> group 9  | <input type="checkbox"/> group 15 |
| <input type="checkbox"/> group 3            | <input type="checkbox"/> group 10 | <input type="checkbox"/> group 16 |
| <input type="checkbox"/> group 4            | <input type="checkbox"/> group 11 |                                   |
| <input type="checkbox"/> group 5            | <input type="checkbox"/> group 12 |                                   |
| <input type="checkbox"/> group 6            |                                   |                                   |
- Information object addresses assigned to each group must be shown in a separate table.

### Clock synchronization

- Clock synchronization (instead via NTP)

### Command transmission

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Direct command transmission  | <input type="checkbox"/> Select and execute command           |
| <input checked="" type="checkbox"/> Direct set point command transmission  | <input type="checkbox"/> Select and execute set point command |
| <input checked="" type="checkbox"/> No additional definition   | <input type="checkbox"/> C_SE_ACTTERM used                    |
| <input checked="" type="checkbox"/> Short-pulse duration (duration determined by a system parameter in the outstation) |   |
| <input checked="" type="checkbox"/> Long-pulse duration (duration determined by a system parameter in the outstation)  |   |
| <input checked="" type="checkbox"/> Persistent output  |   |

### Transmission of integrated totals

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Counter read      | <input checked="" type="checkbox"/> General request counter |
| <input type="checkbox"/> Counter freeze without reset | <input checked="" type="checkbox"/> Request counter group 1 |
| <input type="checkbox"/> Counter freeze with reset    | <input type="checkbox"/> Request counter group 2            |
| <input type="checkbox"/> Counter reset                | <input type="checkbox"/> Request counter group 3            |
|   | <input type="checkbox"/> Request counter group 4            |

The addresses for each group must be defined.

**Parameter loading**

- Threshold value
- Smoothing factor

**Parameter activation**

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

### 3 Supported quality identifiers

The quality identifiers specified in the IEC 60870-5-101/104 standard are listed in this specification and their meaning is described in more detail. Bit  $n$  corresponds to a value of  $2^{n-1}$ . Except for a restart, changing the quality identifiers will cause the corresponding object to be transferred. For objects with time, the time indicates the time of the last change of the object itself or the quality identifier.

BL bit 5 0 = unblocked, 1 = blocked

If an object is not forwarded despite correct entry (e.g., out of service or flutter suppression), the last value entered before blocking is transferred to a general query and the identification BL = 1 is set.

SB bit 6 0 = unreplaced, 1 = replaced

If the object is not delivered directly from a data acquisition card (digital input, analog input, etc.), SB=1 is set.

IV bit 8 0 = valid, 1 = invalid

If the entry is defective or incorrect, the value is flagged as not valid.

Each value is marked as invalid until the first correct entry. If a value is OOS, it is marked as invalid. If a process image of all subordinate stations is managed in a station, all information objects of a subordinate station receive the ID invalid (IV=1) in the event of a connection fault to this subordinate station.

In addition to the IV bit, the following IDs are also supported for counter values:

CY bit 6 0 = no carry over,  
1 = carry over in the corresponding measurement period

If an overflow occurred in the last measurement period, the currently transmitted counter value is given the marking CY=1.

CA bit 7 0 = counter not set,  
1 = counter was set in the last measurement period

If a counter is changed manually during a measurement period, the next count telegram is marked with CA=1.

### 3.1 Quality codes for measurements

The quality labels NT, SB, and BL are not supported and must be set to "0".

Event	IV	NT	SB	BL	OV
Restart (value has not been recorded since restart)	1	0	0	0	0
Correct detection	0	0	0	0	0
Detection defective	1	0	0	0	0
Area overrun	1	0	0	0	0
OOS	1	0	0	1	0
Value is locked	1	0	0	1	0
Substitute value	0	0	1	0	0
Value OOS and substitute value	0	0	1	1	0
Value no longer recorded	0	0	0	1	0

### 3.2 Quality codes for messages

The quality labels NT, SB, and BL are not supported and must be set to "0".

Event	IV	NT	SB	BL
Restart	1	0	0	0
Correct detection	0	0	0	0
Fluttering active	0	0	0	1
Detection defective	1	0	0	0
OOS	1	0	0	1
Value is locked	1	0	0	1
Substitute value	0	0	1	0
OOS and substitute value	0	0	1	1
Locked and substitute value	0	0	1	0
Suppressed	1	0	1	0

### 3.3 Quality codes for counters

Event	IV	CA	CY
Detection defective	1	0	0
OOS	1	1	0
Overflow	0	0	1
Correct detection	0	0	0
Counter is set	0	1	0
Decimal overflow	0	1	1