Standard 12-Lead ECG waveform

Electrocardiography

- **Introduction**
  - NWIP 22077-2: Electrocardiography
  - Standard 12 lead ECG waveform
  - Measurement value
  - Waveform recognition point
  - Interpretation
  - Comparison with SCP-ECG
  - Topics of IHE-J Cardiology

Classification	Type	Value	Description	Reference	Remarks
MFER Format Encoding		0	Unidentified		
Electrocardiogram	**ECG_STD12**	**1**	**Standard 12 lead ECG**	**Part3-1**	**Different kinds of 12 lead ECGs including general ECGs can be encoded.**
	ECG_LTERM	2	Long-term ECG	Part3-2	Holter ECG, monitoring ECG
	ECG_VECTR	3	Vectorcardiogram	**Part3-5**	
	ECG_EXCER	4	Stress ECG	**Part3-3**	
	ECG_INTR	5	Intracardiac ECG	**Part3-4**	His bundle ECG, intracardiac ECG, intravascular ECG, cardiac surface ECG
	ECG_SURF	6	Body surface ECG	**Part3-5**	Body surface potential map Body surface His bundle ECG
	ECG_ILATE	7	Ventricular late potential	**Part3-5**	
	ECG_LATE	8	Body surface late potential	**Part3-5**	
Sound	**SOUND**	30	PCG, etc.	**Part3-13**	8 kHz,11 kHz,22 kHz etc.
Pulse	**PULSE**	31	Fingertip pulse, carotid pulse	**Part3-14**	
Monitoring	**MON_LTRM**	20	Long-term waveform	**Part3-10**	
	MON_SPL	21	Sampled waveform	**Part3-10**	
	MON_PWR	25	Power spectrum	**Part3-9**	Some part is EEG_CSA.
	MON_TRD	26	Trendgram	**Part3-11**	
Magnetocardiogram		100	MCG	**Part3-12**	
Electroencephalogram	**EEG_REST**	40	Resting EEG	**Part3-6**	Includes surgical monitoring EEG.
	EEG_EP	41	Evoked EEG	**Part3-7**	ABR SEP
	EEG_CSA	42	Frequency analysis	**Part3-8**	
	EEG_LTRM	43	Long-term EEG	**Part3-6**	Sleeping EEG
Private	49152～65535				
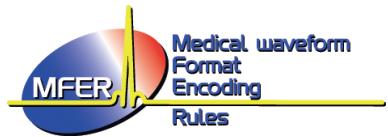
Encoding

Electrocardiography data

Patient information
- Patient ID → MWF_PID(82)
- Patient name → MWF_PNM(81)
- Patient sex → MWF_SEX(84)
- Patient age → MWF_AGE(83)
- Date/time of measurement → MWF_TIM(85)

Waveform informaiton
- Sampling interval → MWF_IVL(0B)
- Sensitivity (resolution) → MWF_SEN(0C)
- Number of channels → MWF_CHN(05)
- Waveform data → MWF_WAV(1E)

Measurement information
- Measurement value → MWF_VAL(42)
- Measurement recognition point → MWF_EVT(41)
- Interpretation → MWF_EVT(41)

MFER Tag(code)
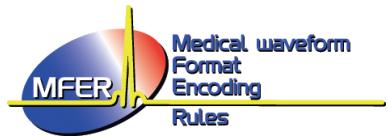
Standard 12 lead ECG waveform

MWF_WAV(08h): waveform class

Kind	Type	Waveform description	Remarks
ECG	ECG_STD12	Standard 12 lead ECG	Standard 12 lead ECG including general ECG in short term recording.
	ECG_DOMT	Dominant beat	One beat waveform extracted from standard 12 lead ECG recording.
	ECG_AVE	Average beat	Signal P-QRS-T waveform averaged with synchronized by fiducial point.
	ECG_MED	Median beat	Beats of the shame shape combined into an accurate, representative cycle

Standard 12 lead ECG waveform

- Lead name

Code	Lead	Code	Lead	Code	Lead
1	Ⅰ	9	V7	63	aVL
2	Ⅱ	11	V3R	64	aVF
3	V1	12	V4R	65	-aVR
4	V2	13	V5R	66	V8
5	V3	14	V6R	67	V9
6	V4	15	V7R	68	V8R
7	V5	61	Ⅲ	69	V9R
8	V6	62	aVR	:	
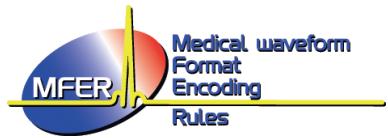
Standard 12 lead ECG waveform

- **1ch ECG**
  - 1ch × 12 recording
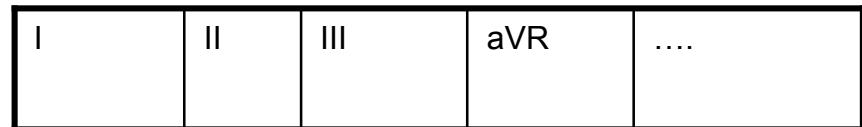
  - 3ch × 4 recording
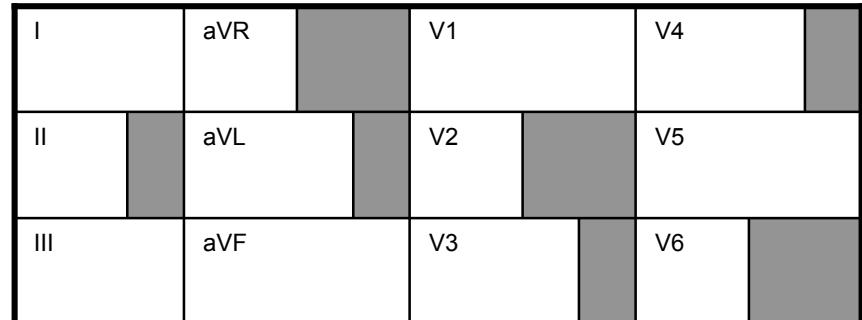
  - 6ch × 2 recording
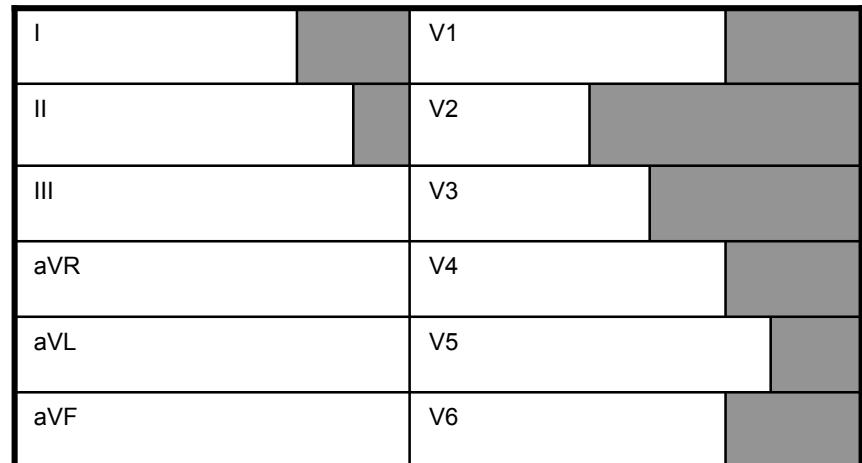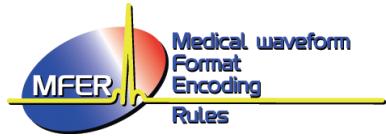
- **3ch ECG**
  - 3ch × 4 recording

I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6

  - 6ch × 2 recording

I		V1	
II		V2	
III		V3	
aVR		V4	
aVL		V5	
aVF		V6	

Extracted waveform

MFER — Medical waveform Format Encoding Rules

- **Beat Infrmation**

  ❑ Dominant beat

  ❑ Average beat

  ❑ Median beat
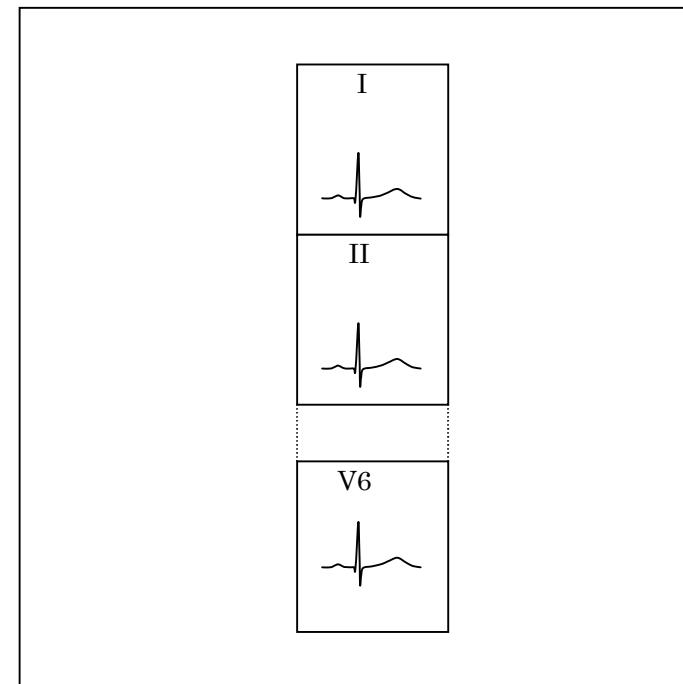
Measurement value

- Measurement value with no lead designation

Code
Code
Time
Value

Code	Name
8001 h	HR
8002 h	R-R interval
8004 h	P wave axis
8006 h	QRS wave axis
8008 h	T wave axis
800E h	P-P interval
800A h	VPC / min.
800C h	VPC / hour

Measurement value

- Measurement value allowed to designate for each lead

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Measurement value code									Lead code						

ex) E681h : QT interval of laed I

Code	Name
E080 h	P width
E200 h	PQ interval
E280 h	Q duration
E300 h	Q amplitude
E380h	QRS duration
E390 h	R duration
E400 h	R amplitude
E840 h	S duration
E480 h	S amplitude
E500 h	STj
E580 h	ST
E600 h	T amplitude
E680 h	QT interval
E700 h	QTc
:	

Measurement recognition point

- Measurement recognition point
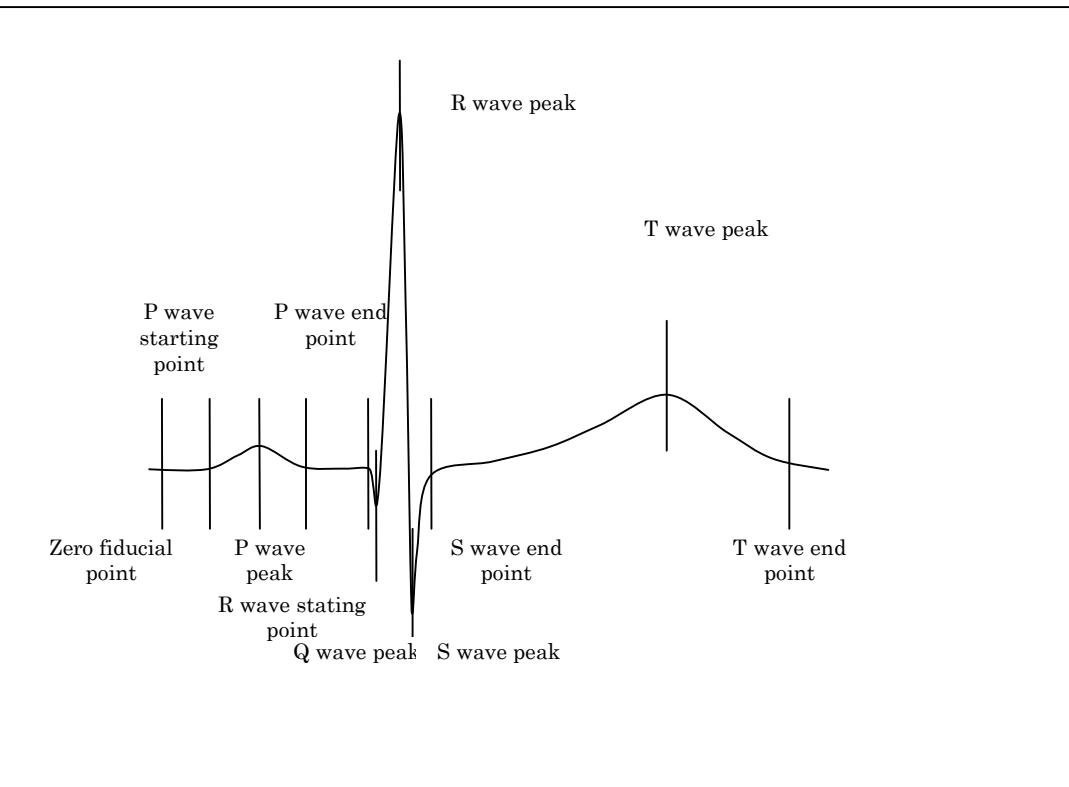
Code
Starting time
Ending time
Supplementary Information
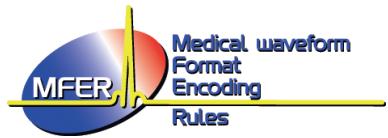
Measurement recognition point

1 6	1 5	1 4	1 3	1 2	1 1	1 0	9	8	7	6	5	4	3	2	1
Waveform recognition point code							0	0	Lead code						

ex) A803h : Q wave of lead V1

| Code	Name
DA00 h	Dominant beat
DC00 h	Average beat
8A00 h	P wave
8C00 h	P2 wave
A200 h	QRS complex
A400 h	QRS peak
A800 h	Q wave
AA00 h	Q wave peak
AC00 h	R wave
AE00 h	R wave peak
B000 h	R' wave
B200 h	R' wave peak
B800 h	S wave
BA00 h	S wave peak
CA00 h	T wave end
CC00 h	T wave peak
:	
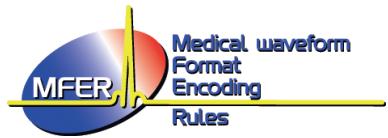
Interpretation

- For event information, "interpretation text^code system (manufacturer name)^abbreviation or code" (continued by "&" if a plurality is encoded) are encoded

ex)

In the event that reasoning is encoded more in detail and in the event that event information is added after adding MFER code MWF_ECG_INF_ANTSEP (480) and questions (2):

Q width: 40 ms or more at V2 + V3/V4

Interpretation code
Starting time
Duration
Interpretation descriptive Information
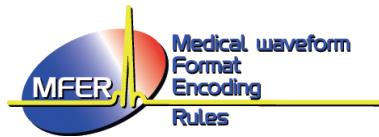
Retrieve ECG for document

Simply Display
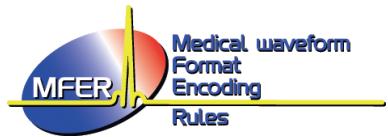
Retrieve ECG for document 実装例

Advanced display

Demo screen

Fukuda
denshi

(Ambulance car)

Nihon
Kohden

(Hospital)