Closed Loop CPR System Communication Protocol

Set / Get CPR Function States [Size: 2 bytes]

Get or set the state of the CPR function flags. Used by host to set the state of the CPR functions (compression and ventilation), and to query the embedded system for the current state of the system. Setting / resetting the MEAS flag starts / stops the embedded system streaming data back to the host (e.g., pressure and chest compressor position measurement data).

When the host requests the status of the state flags, the embedded system replies with a two byte message with the same format used by the host when setting the state flags but with the "get" command echoed (see below).

```
uint8_t CMD,      uint8_t STATE_FLAGS;
```

Command	Data
CMD	[STATE_FLAGS]

CMD	Description	Data Flow
0x10	Get CPR function states	PC → CLCPR
0x11	Set CPR function states	PC → CLCPR

CMD	Description	Data Flow
0x10	Response containing the flag states	CLCPR → PC

State Flags – A byte containing single binary digit flags indicating / controlling the state of the subsystems.

7	6	5	4	3	2	1	0
n/a	n/a	n/a	n/a	MEAS	SYNC	VENT	COMP

COMP = 0b00000001 (0x01)	Chest Compression	0 : OFF	1 : ON
VENT = 0b00000010 (0x02)	Ventilation	0 : OFF	1 : ON
SYNC = 0b00000100 (0x04)	Sync COMP : VENT	0 : OFF	1 : ON
MEAS = 0b00001000 (0x08)	Measurement stream	0 : OFF	1 : ON

CPR Phase Times [Size: 9 bytes]

Sets the phase times for CPR functions: Compression Time, Decompression Time, Inspiratory Time, Expiratory Time.

```
uint8_t CMD,      uint16_t[] CPRPT[4];
                  byte[] CPRPTData[8];
```

CMD	CPRPT[0]		CPRPT [1]		CPRPT [2]		CPRPT[3]	
Command	Compression phase time (ms)		Decompression phase time (ms)		Inspiratory phase time (ms)		Expiratory phase time (ms)	
0x20	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB

LSB = Least significant byte, MSB = Most significant byte

CMD	Description	Data Flow
0x20	Set CPR function phase times	PC → CLCPR

Firmware Version Number [Size: 3 bytes]

Two byte array containing the major and minor firmware version numbers, assigned at time of manufacture – read only (embedded in firmware)

```
byte CMD,   byte MAJOR_VERSION, byte MINOR_VERSION;
            byte[] FVNPkt[2];
```

Command	FVN	
CMD	FVNPkt[0]	FVNPkt[1]
0xA0	MAJOR_VERSION	MINOR_VERSION

CMD	Description	Data Flow
0xA3	Read FVNPkt from CLCPR	CLCPR → PC

Hardware Version Number [Size: 3 bytes]

Two byte array containing the major and minor hardware (PCBA) version numbers, assigned at time of manufacture – (Stored in EEPROM)

```
byte CMD,   byte MAJOR_VERSION, byte MINOR_VERSION;
            byte[] HVNPkt[2];
```

Command	HVN	
CMD	HVNPkt[0]	HVNPkt[1]
0xA1	MAJOR_VERSION	MINOR_VERSION

CMD	Description	Data Flow
0xA4	Read HVNPkt from CLCPR	CLCPR → PC
0xA5	Set HVNPkt	PC → CLCPR

Controlled Parameter	MIN	MAX	Unit
Chest compression rate	40	140	/min
Chest compression duty cycle	30	70	%
Chest compression force	0	180	lb_f
Chest decompression force	0	180	lb_f
Ventilation rate	0	60	/min
Ventilation flow rate	0	60,000	mL/min
Ventilation time	0	2	s
Synchronize ventilation	OFF	ON	

Measured Parameter	FS	Unit
Chest compression position	20	cm
Chest compression force	180	lb_f
Chest decompression force	180	lb_f
Ventilation volume	2,000	mL

Measured parameters are displayed through the host app GUI and as proportional analog signals (0 - 10 VDC full scale)