

# **VMB4PD**

**LCD module for VELBUS system**

# VELBUS protocol

Binary format:

<SOF-SID10...SID0-RTR-IDE-r0-DLC3...0-DATABYTE1...DATABYTE<sub>n</sub>-CRC15...CRC1-CRCDEL-ACK-ACKDEL-EOF7...EOF1-IFS3...IFS1>

<i>bits</i>	<i>Description</i>
SOF	Start Of Frame (always 0)
SID10 & SID9	Priority (00: highest ... 11: lowest priority)
SID8...SID1	Address
SID0	Always 0
RTR	Remote Transmit Request
IDE	Identifier Extension (always 0)
R0	reserved (always 0)
DLC3...DLC0	Data Length Code (0...8)
Databyte1	Command
Databyte2	Parameter
Databyte3	Parameter
Databyte4	Parameter
Databyte5	Parameter
Databyte6	Parameter
Databyte7	Parameter
Databyte8	Parameter
CRC15...CRC1	Cyclic Redundancy Checksum
CRCDEL	CRC Delimiter (always 1)
ACK	Acknowledge slot (transmit 1 readback 0 if received correctly)
ACKDEL	Acknowledge Delimiter (always 1)
EOF7...EOF1	End Of Frame (always 1111111)
IFS3...IFS1	InterFrame Space (always 111)

*The push button module can transmit the following messages:*

- Push button status
- Module type
- Bus error counter status
- Module status
- Module backlight/contrast status
- First, second and third part of the push button name
- First, second and third part of a lcd line
- Memory data
- Memory data block (4 bytes)
- Real-time clock status

*The push button module can receive the following commands:*

- Update LEDs
- Clear LEDs
- Set LEDs
- Blink LEDs slowly
- Blink LEDs fast
- Blink LEDs very fast
- Module type request
- Bus error counter status request
- Module status request
- Push button name request
- Push button labels (lcd lines) request
- Set lcd backlight
- Return to default lcd backlight
- Set push button backlight
- Return to default push button backlight
- Module backlight/contrast status request
- Real-time clock status request
- Set real-time clock
- Enable/disable push button timers

- Read memory data
- Memory dump request
- Write memory data
- Write memory data block (4 bytes) (Build 0743 or higher)

***Transmits the push button status:***

SID10-SID9 = 00 (highest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 4 databytes to send  
 DATABYTE1 = COMMAND\_PUSH\_BUTTON\_STATUS (H'00')  
 DATABYTE2 = Push buttons just pressed (1 = just pressed)  
 DATABYTE3 = Push buttons just released (1 = just released)  
 DATABYTE4 = Push buttons long pressed (1 = longer than 0.85s pressed)

***Transmits the module status:***

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 6 databytes to send  
 DATABYTE1 = COMMAND\_MODULE\_STATUS (H'ED')  
 DATABYTE2 = Input switches status (1 = closed)  
 DATABYTE3 = LEDs continuous on status (1 = LED on)  
 DATABYTE4 = LEDs slow blinking status (1 = LED slow blinking)  
 DATABYTE5 = LEDs fast blinking status (1 = LED fast blinking)  
 DATABYTE6 = push button timer enable bits (1 = timer enabled)

Remarks:

The continuous on bit overrides the blinking modes.

If the slow and fast blinking bits for a LED are both on, the LED blinks very fast.

***Transmits the module type:***

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 8 databytes to send  
 DATABYTE1 = COMMAND\_MODULE\_TYPE (H'FF')  
 DATABYTE2 = PUSHBUTTON\_TIMER\_MODULE (H'0B')  
 DATABYTE3 = LEDs continuous on status (1 = LED on)  
 DATABYTE4 = LEDs slow blinking status (1 = LED slow blinking)  
 DATABYTE5 = LEDs fast blinking status (1 = LED fast blinking)  
 DATABYTE6 = Build year  
 DATABYTE7 = Build week  
 DATABYTE8 = Operating mode (bit0 = timer on/off - bit1 = 4/8 channel - bit3 = display labels/ clock)

<b><i>Contents operating mode'</i></b>	<b><i>Description</i></b>
B'00000000'	Timer mode off
B'00000001'	4 channel timer mode / display button labels
B'00000101'	4 channel timer mode / display clock
B'00000011'	8 channel timer mode / display button labels
B'00000111'	8 channel timer mode / display clock

Remarks:

The continuous on bit overrides the blinking modes.

If the slow and fast blinking bits for a LED are both on, the LED blinks very fast.

***Transmits the first part of the push button name:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 8 databytes to send  
DATABYTE1 = COMMAND\_PUSH\_BUTTON\_NAME\_PART1 (H'F0')  
DATABYTE2 = Push button bit number ('00000001' = Push button 1 ... '10000000' = Push button 8)  
DATABYTE3 = Character 1 of the push button name  
DATABYTE4 = Character 2 of the push button name  
DATABYTE5 = Character 3 of the push button name  
DATABYTE6 = Character 4 of the push button name  
DATABYTE7 = Character 5 of the push button name  
DATABYTE8 = Character 6 of the push button name

***Transmits the second part of the push button name:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 8 databytes to send  
DATABYTE1 = COMMAND\_PUSH\_BUTTON\_NAME\_PART2 (H'F1')  
DATABYTE2 = Push button bit number ('00000001' = Push button 1 ... '10000000' = Push button 8)  
DATABYTE3 = Character 7 of the push button name  
DATABYTE4 = Character 8 of the push button name  
DATABYTE5 = Character 9 of the push button name  
DATABYTE6 = Character 10 of the push button name  
DATABYTE7 = Character 11 of the push button name  
DATABYTE8 = Character 12 of the push button name

***Transmits the third part of the push button name:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 6 databytes to send  
DATABYTE1 = COMMAND\_PUSH\_BUTTON\_NAME\_PART3 (H'F2')  
DATABYTE2 = Push button bit number ('00000001' = Push button 1 / '10000000' = Push button 8)  
DATABYTE3 = Character 13 of the push button name  
DATABYTE4 = Character 14 of the push button name  
DATABYTE5 = Character 15 of the push button name  
DATABYTE6 = H'FF'

Remarks:

Unused characters contain H'FF'.

***Transmits the first part of the lcd line text:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 8 databytes to send  
DATABYTE1 = COMMAND\_LCD\_LINE\_TEXT\_PART1 (H'CD')  
DATABYTE2 = lcd line bit number ('00000001' = line 1 ... '00001000' = line 4)  
DATABYTE3 = Character 1 of the lcd line text  
DATABYTE4 = Character 2 of the lcd line text  
DATABYTE5 = Character 3 of the lcd line text  
DATABYTE6 = Character 4 of the lcd line text  
DATABYTE7 = Character 5 of the lcd line text  
DATABYTE8 = Character 6 of the lcd line text

**Transmits the second part of the lcd line text:**

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 8 databytes to send  
 DATABYTE1 = COMMAND\_LCD\_LINE\_TEXT\_PART2 (H'CE')  
 DATABYTE2 = lcd line bit number ('00000001' = line 1 ... '00001000' = line 4)  
 DATABYTE3 = Character 7 of the lcd line text  
 DATABYTE4 = Character 8 of the lcd line text  
 DATABYTE5 = Character 9 of the lcd line text  
 DATABYTE6 = Character 10 of the lcd line text  
 DATABYTE7 = Character 11 of the lcd line text  
 DATABYTE8 = Character 12 of the lcd line text

**Transmits the third part of the lcd line text:**

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 6 databytes to send  
 DATABYTE1 = COMMAND\_LCD\_LINE\_TEXT\_PART3 (H'CF')  
 DATABYTE2 = lcd line bit number ('00000001' = line 1 ... '00001000' = line 4)  
 DATABYTE3 = Character 13 of the lcd line text  
 DATABYTE4 = Character 14 of the lcd line text  
 DATABYTE5 = Character 15 of the lcd line text  
 DATABYTE6 = Character 15 of the lcd line text

Remarks:

Unused characters contain H'FF'.

**Transmit backlight/contrast status**

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 2 databytes to send  
 DATABYTE1 = COMMAND\_BACKLIGHT\_STATUS (H'D6')  
 DATABYTE2 = Backlight/contrast status (bit7&6: lcd backlight - bit5&4: button backlight - bit3...0: lcd contrast)

<i>Contents backlight/contrast status'</i>	<i>Description</i>
B'00xxxxxx'	LCD backlight off
B'01xxxxxx'	LCD backlight dim low brightness
B'10xxxxxx'	LCD backlight dim high brightness
B'11xxxxxx'	LCD backlight maximum brightness
B'xx00xxxx'	Push button backlight off
B'xx01xxxx'	Push button backlight dim low brightness
B'xx10xxxx'	Push button backlight dim high brightness
B'xx11xxxx'	Push button backlight maximum brightness
B'xxx0000'	LCD contrast: maximum
...	
B'xxx1111'	LCD contrast: minimum

**Transmits the memory data:**

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 4 databytes to send  
 DATABYTE1 = COMMAND\_MEMORY\_DATA (H'FE')  
 DATABYTE2 = High memory address (must be H'00')  
 DATABYTE3 = LOW memory address (H'00'...H'FF')  
 DATABYTE4 = memory data

**Transmits memory data block (4 bytes):**

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address of the module  
 RTR = 0  
 DLC3...DLC0 = 4 databytes to send  
 DATABYTE1 = COMMAND\_MEMORY\_DATA\_BLOCK (H'CC')  
 DATABYTE2 = High start address of memory block (must be H'00')  
 DATABYTE3 = LOW start address of memory block (H'00'...H'FC')  
 DATABYTE4 = memory data1  
 DATABYTE5 = memory data2  
 DATABYTE6 = memory data3  
 DATABYTE7 = memory data4

**Transmit: Bus error counter status**

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = Address set by hex switches  
 RTR = 0  
 DLC3...DLC0 = 4 databytes to send  
 DATABYTE1 = COMMAND\_BUSEROR\_COUNTER\_STATUS (H'DA')  
 DATABYTE2 = Transmit error counter  
 DATABYTE3 = Receive error counter  
 DATABYTE4 = Bus off counter

**Transmit: Real time clock status**

SID10-SID9 = 11 (lowest priority)  
 SID8...SID1 = H'00'  
 RTR = 0  
 DLC3...DLC0 = 4 databytes to send  
 DATABYTE1 = COMMAND\_REALTIME\_CLOCK\_STATUS (H'D8')  
 DATABYTE2 = Day of week

<i>Contents day of week'</i>	<i>Description</i>
H'00'	Monday
H'01'	Tuesday
H'02'	Wednesday
H'03'	Thursday
H'04'	Friday
H'05'	Saturday
H'06'	Sunday

DATABYTE3 = Hours (0...23)  
 DATABYTE4 = Minutes (0...59)

***‘Update LED status’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 4 databytes received  
DATABYTE1 = COMMAND\_UPDATE\_LED\_STATUS (H’F4’)  
DATABYTE2 = LED continuous on status (1 = LED on)  
DATABYTE3 = LED slow blinking status (1 = LED slow blinking)  
DATABYTE4 = LED fast blinking status (1 = LED fast blinking)

Remarks:

The continuous on bit overrides the blinking modes.

If the slow and fast blinking bits for a LED are both on, the LED blinks very fast.

***‘Clear LED’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_CLEAR\_LED (H’F5’)  
DATABYTE2 = LEDs to clear (a one clears the corresponding LED)

***‘Set LED’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_SET\_LED (H’F6’)  
DATABYTE2 = LEDs to set (a one sets the corresponding LED)

***‘Slow blinking LED’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_SLOW\_BLINKING\_LED (H’F7’)  
DATABYTE2 = LEDs to blink slow (1 = slow blinking)

***‘Fast blinking LED’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_FAST\_BLINKING\_LED (H’F8’)  
DATABYTE2 = LEDs to blink fast (1 = fast blinking)

***‘Very fast blinking LED’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_VERYFAST\_BLINKING\_LED (H’F9’)  
DATABYTE2 = LEDs to clear (1 = very fast blinking)

***‘Module status request’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_MODULE\_STATUS\_REQUEST (H’FA’)  
DATABYTE2 = Input channel bit numbers (B’11111111’)

***‘Module type request’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 1  
DLC3...DLC0 = 0 databytes received

***‘Bus error counter status request’ command received:*** (Build 0649 or higher)

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address set by hex switches  
RTR = 0  
DLC3...DLC0 = 1 databytes to send  
DATABYTE1 = COMMAND\_BUS\_ERROR\_COUNTER\_STATUS\_REQUEST (H'D9')

***‘Push button name request’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_PUSH\_BUTTON\_NAME\_REQUEST (H'EF')  
DATABYTE2 = Push button number (B'00000001' = Push button 1 ... B'10000000' = Push button 8)

***‘LCD line text request’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_LCD\_LINE\_TEXT\_REQUEST (H'D0')  
DATABYTE2 = Push button number (B'00000001' = line 1 ... B'00001000' = line 4)

***‘Module backlight/contrast status request’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 1 databytes received  
DATABYTE1 = COMMAND\_BACKLIGHT\_CONTRAST\_STATUS\_REQUEST (H'D5')

***‘Set lcd backlight’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_SET\_LCD\_BACKLIGHT (H'F3')  
DATABYTE2 = Backlight value (H'00' = off, H'01' = dim low, H'02' = dim high, H'03' = max)

***‘Return to default lcd backlight’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 1 databytes received  
DATABYTE1 = COMMAND\_RETURN\_TO\_DEFAULT\_LCD\_BACKLIGHT (H'D2')

***‘Set push button backlight’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 2 databytes received  
DATABYTE1 = COMMAND\_SET\_PUSH\_BUTTON\_BACKLIGHT (H'D4')  
DATABYTE2 = Backlight value (H'00' = off, H'01' = dim low, H'02' = dim high, H'03' = max)

***‘Return to default push button backlight’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 1 databytes received  
DATABYTE1 = COMMAND\_RETURN\_TO\_DEFAULT\_PUSH\_BUTTON\_BACKLIGHT (H'D3')

***‘Read data from memory’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 3 databytes received  
DATABYTE1 = COMMAND\_READ\_DATA\_FROM\_MEMORY (H'FD')  
DATABYTE2 = High memory address (must be H'00')  
DATABYTE3 = LOW memory address (H'00'...H'FF')

***‘Memory dump request’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 1 databytes received  
DATABYTE1 = COMMAND\_MEMORY\_DUMP\_REQUEST (H'CB')

***‘Write data to memory’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address of the module  
RTR = 0  
DLC3...DLC0 = 4 databytes received  
DATABYTE1 = COMMAND\_WRITE\_DATA\_TO\_MEMORY (H'FC')  
DATABYTE2 = High memory address (must be H'00')  
DATABYTE3 = LOW memory address (H'00'...H'FF')  
DATABYTE4 = memory data to write

Remark:

Wait at least 10ms for sending a next command on the velbus.

***‘Write memory block’ command received:*** (Build 0743 or higher)

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = Address set by hex switches  
RTR = 0  
DLC3...DLC0 = 7 databytes received  
DATABYTE1 = COMMAND\_WRITE\_MEMORY\_BLOCK (H'CA')  
DATABYTE2 = High memory address (must be H'00')  
DATABYTE3 = LOW memory address (H'00'...H'FC')  
DATABYTE4 = memory databyte1 to write  
DATABYTE5 = memory databyte2 to write  
DATABYTE6 = memory databyte3 to write  
DATABYTE7 = memory databyte4 to write

Remark: Wait for ‘memory data block’ feedback before sending a next command on the velbus.

***‘Real time clock status request’ command received:***

SID10-SID9 = 11 (lowest priority)  
SID8...SID1 = H'00'  
RTR = 0  
DLC3...DLC0 = 1 databytes to send  
DATABYTE1 = COMMAND\_REALTIME\_CLOCK\_STATUS\_REQUEST (H'D7')

Remark:

The real time clock status will only be send if master clock is on.

***‘Set real time clock’ command received:***

SID10-SID9 = 11 (lowest priority)

SID8...SID1 = H'00'

RTR = 0

DLC3...DLC0 = 4 databytes to send

DATABYTE1 = COMMAND\_REALTIME\_CLOCK\_STATUS (H'D8')

DATABYTE2 = Day of week

<i>Contents day of week'</i>	<i>Description</i>
H'00'	Monday
H'01'	Tuesday
H'02'	Wednesday
H'03'	Thursday
H'04'	Friday
H'05'	Saturday
H'06'	Sunday

DATABYTE3 = Hours (0...23)

DATABYTE4 = Minutes (0...59)

***‘Enable/disable push button timers’ command received:***

SID10-SID9 = 11 (lowest priority)

SID8...SID1 = Address of the module

RTR = 0

DLC3...DLC0 = 2 databytes received

DATABYTE1 = COMMAND\_ENABLE\_TIMER\_CHANNELS (H'D1')

DATABYTE2 = Push button channels ( a one enables and a zero disables the timer for a push button)

Remark:

Only channels used into a program step can be enabled.

Wait at least 100ms for sending a next command on the velbus.

## Memory map:

Address	Contents	Address	Contents
H'0000'...H'000E'	Name of push button 1	H'000F'	Response time for push button 1
H'0010'...H'001E'	Name of push button 2	H'001F'	Response time for push button 2
H'0020'...H'002E'	Name of push button 3	H'002F'	Response time for push button 3
H'0030'...H'003E'	Name of push button 4	H'003F'	Response time for push button 4
H'0040'...H'004E'	Name of push button 5	H'004F'	Response time for push button 5
H'0050'...H'005E'	Name of push button 6	H'005F'	Response time for push button 6
H'0060'...H'006E'	Name of push button 7	H'006F'	Response time for push button 7
H'0070'...H'007E'	Name of push button 8	H'007F'	Response time for push button 8
H'0080'...H'008F'	LCD line1 text		
H'0090'...H'009F'	LCD line2 text		
H'00A0'...H'00AF'	LCD line3 text		
H'00B0'...H'00BF'	LCD line4 text		
H'00C0'	Prog step1: day/hour set	H'00C1'	Prog step1: day/min set
H'00C2'	Prog step1: button action		
...			
H'00F9	Prog step20: day/hour set	H'00FA'	Prog step20: day/min set
H'00FB'	Prog step20: button action		
H'00FC'	LCD backlight timer1	H'00FD'	LCD Backlight timer2
H'00FE'	Backlight/contrast setting	H'00FF'	Module address

A maximum of 15 characters can be stored for every push button name. Unused characters and memory locations contains H'FF'.

### Valid response times are:

- H'05' : 65ms
- H'26' : 0.5s
- H'4C' : 1s
- H'99' : 2s
- H'E0' : 3s

### Valid characters on LCD:

Value	Char	Value	Char	Value	Char	Value	Char	Value	Char	Value	Char
H'20'		H'30'	0	H'40'	@	H'50'	P	H'60'	`	H'70'	p
H'21'	!	H'31'	1	H'41'	A	H'51'	Q	H'61'	a	H'71'	q
H'22'	"	H'32'	2	H'42'	B	H'52'	R	H'62'	b	H'72'	r
H'23'	#	H'33'	3	H'43'	C	H'53'	S	H'63'	c	H'73'	s
H'24'	\$	H'34'	4	H'44'	D	H'54'	T	H'64'	d	H'74'	t
H'25'	%	H'35'	5	H'45'	E	H'55'	U	H'65'	e	H'75'	u
H'26'	&	H'36'	6	H'46'	F	H'56'	V	H'66'	f	H'76'	v
H'27'	'	H'37'	7	H'47'	G	H'57'	W	H'67'	g	H'77'	w
H'28'	(	H'38'	8	H'48'	H	H'58'	X	H'68'	h	H'78'	x
H'29'	)	H'39'	9	H'49'	I	H'59'	Y	H'69'	i	H'79'	y
H'2A'	*	H'3A'	:	H'4A'	J	H'5A'	Z	H'6A'	j	H'7A'	z
H'2B'	+	H'3B'	;	H'4B'	K	H'5B'	[	H'6B'	k	H'7B'	{
H'2C'	,	H'3C'	<	H'4C'	L	H'5C'	¥	H'6C'	l	H'7C'	
H'2D'	-	H'3D'	=	H'4D'	M	H'5D'	]	H'6D'	m	H'7D'	}
H'2E'	.	H'3E'	>	H'4E'	N	H'5E'	^	H'6E'	n		
H'2F'	/	H'3F'	?	H'4F'	O	H'5F'	_	H'6F'	o		

**Backlight/contrast settings:**

Bits 7&amp;6: lcd backlight

Bits 5&amp;4: push button backlight

Bits 3...0: lcd contrast

<b>Contents backlight/contrast status'</b>	<b>Description</b>
B'00xxxxxx'	LCD backlight off
B'01xxxxxx'	LCD backlight dim low brightness
B'10xxxxxx'	LCD backlight dim high brightness
B'11xxxxxx'	LCD backlight maximum brightness
B'xx00xxxx'	Push button backlight off
B'xx01xxxx'	Push button backlight dim low brightness
B'xx10xxxx'	Push button backlight dim high brightness
B'xx11xxxx'	Push button backlight maximum brightness
B'xxxx0000'	LCD contrast: maximum
...	
B'xxxx1111'	LCD contrast: minimum

**Program step day range:**

Bit7 of day/min byte from program steps : day range bit 3

Bit7..5 of day/hour byte from program steps : day range bits 2...0

<b>Day range</b>	<b>Prog step day/min set</b>	<b>Prog step day/hour set</b>
Monday	B'0xxxxxxx'	B'000xxxxx'
Tuesday	B'0xxxxxxx'	B'001xxxxx'
Wednesday	B'0xxxxxxx'	B'010xxxxx'
Thursday	B'0xxxxxxx'	B'011xxxxx'
Friday	B'0xxxxxxx'	B'100xxxxx'
Saturday	B'0xxxxxxx'	B'101xxxxx'
Sunday	B'0xxxxxxx'	B'110xxxxx'
Saturday&Sunday	B'0xxxxxxx'	B'111xxxxx'
Monday - Friday	B'1xxxxxxx'	B'000xxxxx'
Monday - Saturday	B'1xxxxxxx'	B'001xxxxx'
Monday - Sunday	B'1xxxxxxx'	B'010xxxxx'
Never	B'1xxxxxxx'	B'011xxxxx'

**Program step hour set:**

Bit4...0 of day/hour byte from program steps : hours (0...23)

**Program step minute set:**

Bit5...0 of day/min byte from program steps : minutes (0...59)

**Program step push button action:**

Bit0 of button action byte from program steps : push button 1 activation

...

Bit7 of button action byte from program steps : push button 8 activation

**Enable/disable timer for push button:**

Bit6 of day/min byte from program steps 1 to 8 : timer on/off

<i>Step number</i>	<i>Address</i>	<i>Day/minute byte</i>	<i>Description</i>
1	H'00C1'	B'x0xxxxxx'	Timer off for button1
1	H'00C1'	B'01xxxxxx'	Timer on for button1
2	H'00C4'	B'x0xxxxxx'	Timer off for button2
2	H'00C4'	B'x1xxxxxx'	Timer on for button2
3	H'00C7'	B'x0xxxxxx'	Timer off for button3
3	H'00C7'	B'x1xxxxxx'	Timer on for button3
4	H'00CA'	B'x0xxxxxx'	Timer off for button4
4	H'00CA'	B'x1xxxxxx'	Timer on for button4
5	H'00CD'	B'x0xxxxxx'	Timer off for button5
5	H'00CD'	B'x1xxxxxx'	Timer on for button5
6	H'00D0'	B'x0xxxxxx'	Timer off for button6
6	H'00D0'	B'x1xxxxxx'	Timer on for button6
7	H'00D3'	B'x0xxxxxx'	Timer off for button7
7	H'00D3'	B'x1xxxxxx'	Timer on for button7
8	H'00D6'	B'x0xxxxxx'	Timer off for button8
8	H'00D6'	B'x1xxxxxx'	Timer on for button8

**Display clock mode:**

Bit6 of day/min byte program step18 : display push button labels or clock

<i>Step number</i>	<i>Address</i>	<i>Day/minute byte</i>	<i>Description</i>
18	H'00F4'	B'x0xxxxxx'	display push button labels
18	H'00F4'	B'x1xxxxxx'	display clock

**Operating mode :**

Bit6 of day/min byte program step19 : operating as push button panel with or without timers

<i>Step number</i>	<i>Address</i>	<i>Day/minute byte</i>	<i>Description</i>
19	H'00F7'	B'x0xxxxxx'	push button without timer mode
19	H'00F7'	B'x1xxxxxx'	push button with timer mode

**Number of timer channels :**

Bit6 of day/min byte program step20 : operating as push button panel with or without timers

<i>Step number</i>	<i>Address</i>	<i>Day/minute byte</i>	<i>Description</i>
20	H'00FA'	B'x0xxxxxx'	4 timer channels (buttons 5 to 8)
20	H'00FA'	B'x1xxxxxx'	8 timer channels (all buttons)

**LCD backlight timer1 settings:**

bits 7 &amp; 6: lcd backlight

bit 5: backlight timer enable

bit 4...0: backlight time 1 into hours (0...23)

<i>Contents backlight timer1</i>	<i>Description</i>
B'00xxxxxx'	LCD backlight off
B'01xxxxxx'	LCD backlight dim low brightness
B'10xxxxxx'	LCD backlight dim high brightness
B'11xxxxxx'	LCD backlight maximum brightness
B'xx0xxxxx'	LCD backlight timer disabled
B'xx1xxxxx'	LCD backlight timer enabled
B'xxx00000'	LCD backlight time 1 hour: 0
B'xxx00001'	LCD backlight time 1 hour: 1
B'xxx00010'	LCD backlight time 1 hour: 2
...	
B'xxx10111'	LCD backlight time 1 hour: 23

**LCD backlight timer2 settings:**

bits 7 &amp; 6: lcd backlight

bit 5: master clock enable

bit 4...0: backlight time 2 into hours (0...23)

<b><i>Contents backlight timer2</i></b>	<b><i>Description</i></b>
B'00xxxxxx'	LCD backlight off
B'01xxxxxx'	LCD backlight dim low brightness
B'10xxxxxx'	LCD backlight dim high brightness
B'11xxxxxx'	LCD backlight maximum brightness
B'xx0xxxxx'	Master clock disabled
B'xx1xxxxx'	Master clock enabled
B'xxx00000'	LCD backlight time 2 hour: 0
B'xxx00001'	LCD backlight time 2 hour: 1
B'xxx00010'	LCD backlight time 2 hour: 2
...	
B'xxx10111'	LCD backlight time 2 hour: 23