



a module solution provider

MM5D91-0B

60GHz mmWave Radar

Entrance Counter Sensor Module

Command Manual

D01

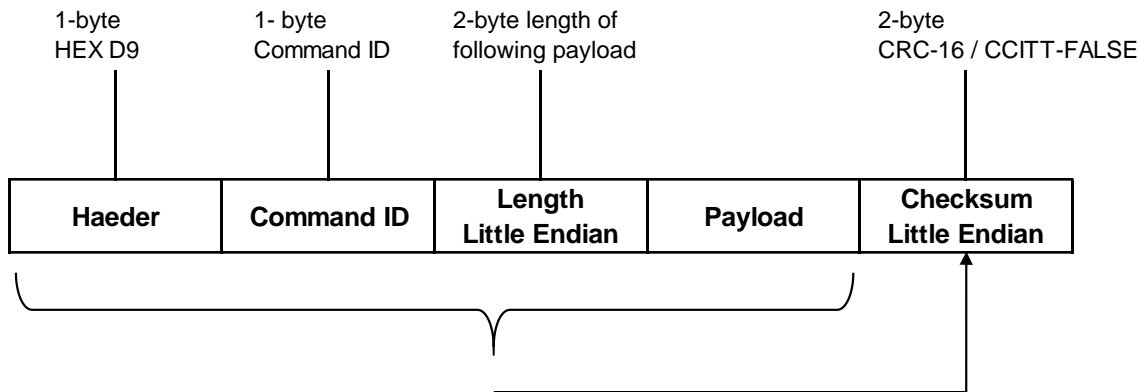
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1. COMMAND STRUCTURE

The structure of a binary command is shown in following diagram.

Header is a fixed byte 0xD9.



Checksum: CRC16 of Header + Command ID + Length + Payload, in CRC-16/CCITT-FALSE format.
Example of C code implementation of the checksum is shown below.

The function will return a 16-bit checksum (in little endian) for the input array.

```

uint16_t crc16(uint8_t *src_data, uint32_t src_data_len)
{
    uint16_t crc = 0xFFFF;
    for (int i = 0; i < src_data_len; i++)
    {
        crc = ((uint8_t)(crc >> 8) | (crc << 8)) ^ src_data[i];
        crc ^= (uint8_t)(crc & 0xFF) >> 4;
        crc ^= (crc << 12);
        crc ^= ((crc & 0xFF) << 5);
    }
    return (crc);
}

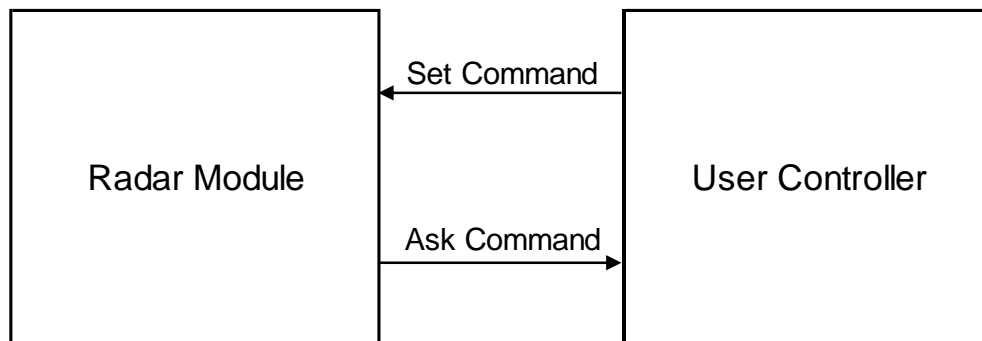
```

2. PROTOCOL MESSAGE FLOW

Command messages are being sent back and forth according to the following conditions.

Set command

1. User send a Set Command to radar module
2. Module reply a ACK Command to imply set success or fail



Example: set entrance width to 1.0m

User send:

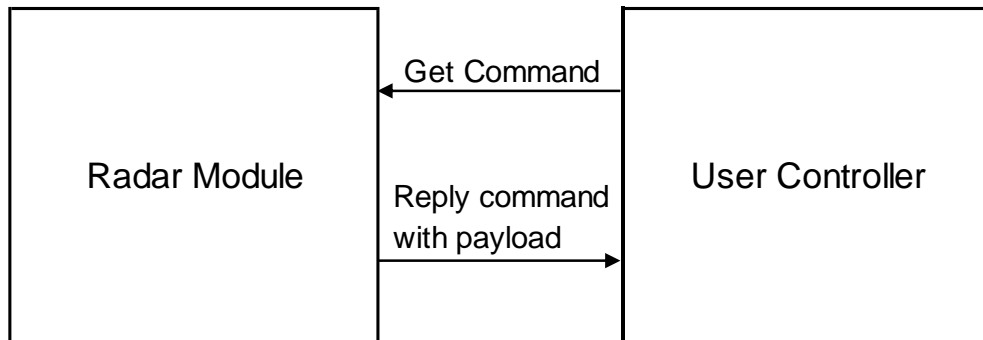
D9 14 04 00 00 00 80 3F EA 72

Module reply:

D9 02 02 00 14 01 3B 94

Get command

1. User send a get command to radar module to poll certain status,
2. Module reply a command with the same command ID and payload. The get command is similar to set command except that it has no payload inside.



Example: get entrance width

User send:

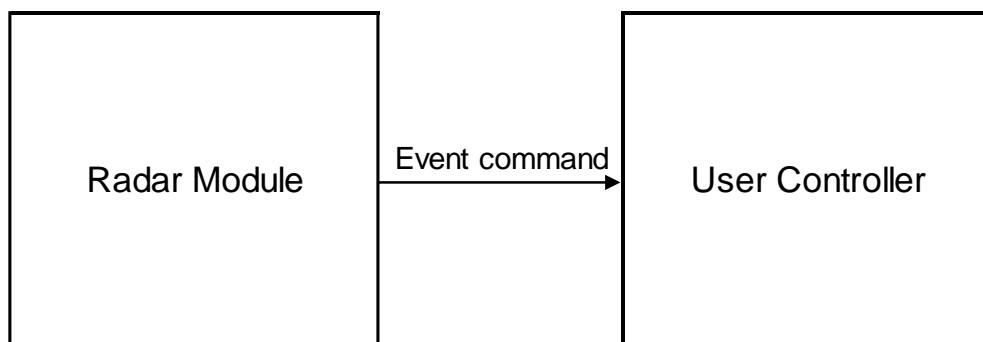
D9 14 00 00 17 40

Module reply, entrance width is 1.0m:

D9 14 04 00 00 00 80 3F EA 72

Event command

1. Module will actively send out command to user to indicate an event change, such as counter in or out event.



Example: counter IN event

Event_time: 436362ms / Event_type: IN detected / In_count: 4 / Out_count: 2

Module send:

D9 18 11 00 8A A8 06 00 00 00 00 00 00 04 00 00 00 02 00 00 00 F4 8B

3. COMMAND LIST

The supported command is shown below.

3.1. Version (0x00)

Packet	Firmware Version				
Command Type	Get				
Comment	This command is used to get the version of the firmware.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x00	N	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	string	version	Firmware version in string format		

3.2. ACK (0x02)

Packet	Acknowledge command				
Command Type	Get				
Comment	This command is acknowledgement from radar module.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x02	2	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	ID	Set command ID to be acknowledged		
1	uint8_t	set_result	Set command result 0: fail 1: success		

3.3. Reset configuration (0x08)

Packet	Reset all configuration to default command				
Command Type	Set				
Comment	This command will reset the setting saved in flash to default, and perform a system reset.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x08	0	N/A	CRC16

3.4. Counter detect enable (0x0A)

Packet	Enable/Disable counter detection				
Command Type	Set				
Comment	This command is used to enable/disable counter detection. Make sure to disable RFCW mode before enabling counter detection. Default is 1.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x0A	1	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	status	Counter detection enable status 0: disable 1: enable		

3.5. RFCW mode (0x0B)

Packet	Set the radar to send out RF continuous wave				
Command Type	Set				
Comment	This command is used to enable the RF test mode for FCC test. Make sure to entrance counter detection before entering this mode.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x0B	1	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	mode	Radar enable status 0: disable RFCW mode 1: RFCW output at 61.02GHz 2: RFCW output at 61.25GHz 3: RFCW output at 61.48GHz 4: RFCW test at 61.02GHz with TX off 5: RFCW test at 61.25GHz with TX off 6: RFCW test at 61.48GHz with TX off		

3.6. Radar chip temperature (0x0D)

Packet	Temperature in radar chip				
Command Type	Get				
Comment	This command is used to get the temperature in radar chip, to check for overheat condition.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x0D	4	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	float	temperature	Temperature of radar chip, in °C		

3.7. Sleep mode (0x0E)

Packet	Set module into sleep mode				
Command Type	Set				
Comment	This command is used set the module into sleep mode to save power consumption. Module will wakeup when up coming command received. A preamble byte such as 0x00 is needed to add in the next command to have the command correctly received at the module (to compensate wakeup delay time).				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x0E	1	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	sleep_mode	1: deep sleep		

3.8. Counter entrance width (0x14)

Packet	Entrance width of people counter detection				
Command Type	Set / Get				
Comment	Valid range is 0.0-3.0. The change will be saved in flash. Default is 1.0.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x14	4	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	float	entrance_width	Entrance width, unit is meter		

3.9. Counter detection orientation (0x15)

Packet	Detection orientation of people counter				
Command Type	Set / Get				
Comment	Placement orientation of the radar chip. The change will be saved in flash. Default is 0.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x15	1	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	orientation	0: portrait mode 1: landscape mode		

3.10. Counter IN/OUT count (0x16)

Packet	IN / OUT count number of people counter				
Command Type	Set / Get				
Comment	Get the current IN/OUT count for the counter. Can use this command to reset count, by setting both numbers to 0.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x16	8	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	UInt32_t	in_count	IN count		
4	UInt32_t	out_count	OUT count		

3.11. Counter IN/OUT reverse (0x17)

Packet	Reverse IN/OUT detection of people counter				
Command Type	Set / Get				
Comment	This command is used to set or get the reverse enable state of people counter. The change will be saved in flash. Default is 0.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x17	1	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	reverse	0: IN / OUT count not reversed 1: IN / OUT count reversed		

3.12. Counter event (0x18)

Packet	Event packet of people counter				
Command Type	Event				
Comment	This event command will send out once for a change in counter detection event.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x18	17	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint64_t	event_time	Event time, in ms		
8	uint8_t	event_type	0: IN detected 1: OUT detected 2: Object detected in detection zone 3: No more object detected in detection zone		
9	uint32_t	in_count	IN count		
13	uint32_t	out_count	OUT count		

3.13. Counter sensor install position (0x19)

Packet	Set install position of radar sensor				
Command Type	Set / Get				
Comment	This command is used to set or get the install position of radar sensor. The change will be saved in flash. Default is 1.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x19	1	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	install_pos	0: Ceiling mount 1: Door side mount		

3.14. Counter ceiling height (0x1A)

Packet	Ceiling height setting for ceiling mount mode detection				
Command Type	Set / Get				
Comment	Valid range is 0.0-3.0. The change will be saved in flash. Default is 2.5.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x1A	4	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	float	ceiling_height	Ceiling height, unit is meter		

3.15. Counter minimum person height (0x1B)

Packet	Minimum person height for ceiling mount mode detection				
Command Type	Set / Get				
Comment	Valid range is 0.0-2.0. The change will be saved in flash. Default is 1.0.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x1B	4	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	float	min_person_height	Minimum person height, unit is meter		

3.16. Counter traffic light zone (0x1C)

Packet	Set the zone size which the traffic light will be effective				
Command Type	Set / Get				
Comment	Valid range is 0.0-1.0. The change will be saved in flash. Default is 1.0.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x1C	4	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	float	traffic_light_zone	Traffic light zone size, unit is meter		

3.17. Counter sensitivity (0x1D)

Packet	Sensitivity of people counter				
Command Type	Set / Get				
Comment	Valid range is 0.0-1.0. The change will be saved in flash. Default is 0.5.				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x1D	4	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	float	counter_sensitivity	Counter sensitivity		

3.18. Counter GPIO mode (0x1E)

Packet	GPIO mode of people counter				
Command Type	Set / Get				
Comment	This command is used to set or get the GPIO activity mode when a counter event exist. The change will be saved in flash. Default is "LED drive mode".				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0x1E	1	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t	GPIO_mode	0: LED drive mode - GPIO0: green - GPIO1: red - GPIO2: blue 1: GPIO active mode - GPIO1: a high pulse for IN count - GPIO2: a high pulse for OUT count - GPIO0: high for counter occupied and low for counter free		

3.19. Unique ID (0xF7)

Packet	Get the unique ID of the module				
Command Type	Get				
Comment	This command is used to get the unique ID of the module				
Packet Structure	Header	ID	Length (Bytes)	Payload	Checksum
	0xD9	0xF7	8	See below	CRC16
Payload Contents					
Byte Offset	Format	Name	Description		
0	uint8_t x 8	unique_id	Module unique ID		

4. HISTORY CHANGE

Revision	Date	Description
D01	2022-01-03	Draft version.