DTM-25 High Speed Data Radio

USER MANUAL

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Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée quivalente (p.i.r.e.) ne dépassepas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Antenna Types to be used by this transmitter: 50 ohm, 6 dBi, Dipole antenna

In terms of Safety Code 6 and RF exposure limits, the 220MHz system operating at 30W transmitter output power in the configurations tested, does not produce NIR in excess of the General Public (uncontrolled access) exposure limits at distances greater than 0.45m from the antenna.

In terms of RF exposure limits, all areas beyond 0.25m and 0.45m from the operating antennas while connected to the 6W and 30W transmitters respectively, are in compliance with Health Canada's Safety Code 6 (version 99-EHD-237) guidelines for occupancy by the General Public (uncontrolled access) and as such therefore, there is no associated health or safety risk associated with the occupancy of these areas.

1 Features and Applications

1.1 Features

- Frequency range: 220MHz-222MHz

- Multi-Channels: The standard configuration provides 41 channels, CH121-CH161, each channel can be programmed.

- Bandwidth: 12.5 KHz, 15 KHz and 25 KHz optional.

- RF power: 5W, 10W, 15W, 20W, 25W, 30W optional.

- Different TX/RX frequency Technology: The radio can transmit and receive signal at different frequency respectively. TX/RX channels can be reversed.

- Safe and Reliable data transmission: M series encryption and even check adopted to ensure safety and reliability of data on air.

- Data port: RS-232.

- Serial port rate available: 9600bps, 19200bps, 38400bps, 57600bps, 115200bps

- RF Data rate optional: 1200bps, 2400bps, 4800bps, 9600bps, 19200bps.

- RSSI output: The data frame includes RSSI information.

- Software upgrade: The radio's software can be upgraded via serial port.

- The radio complies with FCC part 90 and IC.

1.2 Applications

- Long-distance industrial telemetry, telecommand and automation

- Long-distance Safeguard of camera control

- Geography measure and Earthquake monitoring information transmission

- Military training equipment

- LED and city lamp control

- Water conservancy and irrigation works monitoring

- Electric power load control device and Electric power instruments

- City heat-net monitor and weather circumstance monitor.

- Grain depot circumstance monitor

- Oil exploitation automation.

2   Port (Interface) Description

2.1 The connection between DTM-25 and terminal system

DTM-25 provides standard RS232 interface.
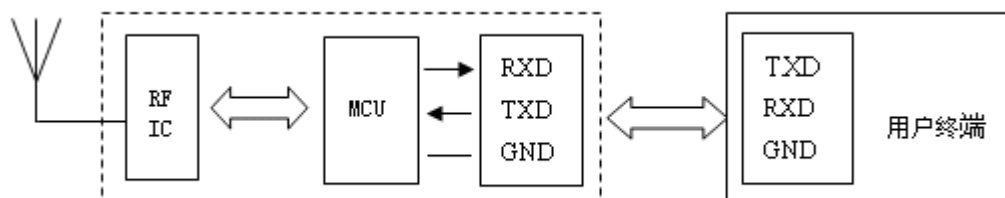

Fig.1 ：The connection between DTM-25 and Terminal system.
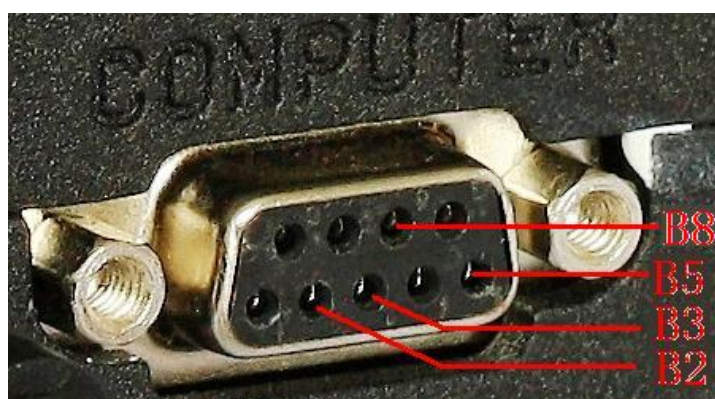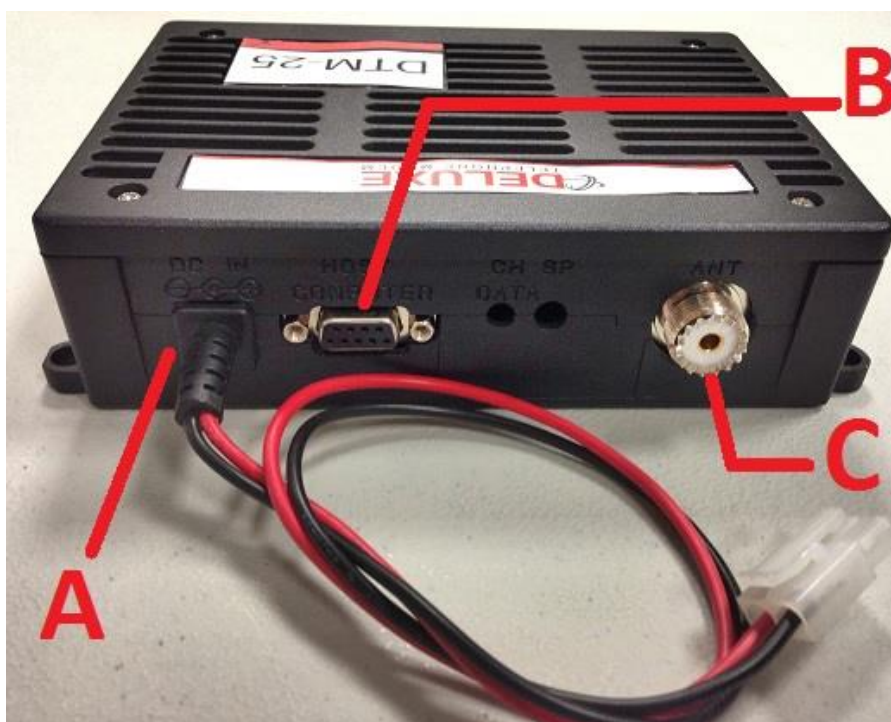
2.2 DTM-25 Port Schematic

Fig.2：Ports Schematic

A----Power Port： Input voltage ＋10.5V --＋15.0V，Power cord comes with fuse.

B-------Data Port DB9：

Pin	Definition
B2	TXD: Standard RS-232 transmit data signal output.
B3	RXD: Standard RS-232 receive data signal input.
B5	GND: Grounding
B8	CTS
B1, B4, B6, B7, B9	NC(reserved)

C-----ANT Port: LS16-KF，Use antenna with standard 50 Ohm impedance.

2.3 DTM-25 LED indicator

DTM-25 Data radio LED as shown in below Fig.3.

Fig. 3.   DTM-25 Data Radio LEDs

PWR: Power Supply LED.
TX/RX: TX/RX LED, TX---RED, RX---GREEN.
RSSI1 RSSI2: RSSI LED

| RSSI1	RSSI2	RSSI range
OFF	OFF	＜ －110dBm
OFF	ON	－85dBm ～－110dBm
ON	OFF	－65dBm ～ －85dBm
ON	ON	＞-65dBm

PL：RF Power LED, The LED is on while in transmitting, the RF power is higher, the LED will be lighter.

3 How to use DTM-25

3.1 Application Schematic

DTM-25 is a wireless data transceiver which can transfer transparent data packet of user device 1 to user device 2. Its application schematic is **s**hown below:
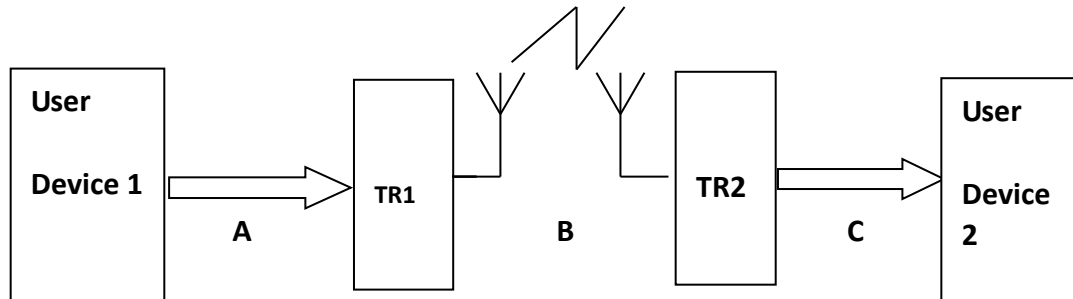
Fig. 3.1:   Application Schematic
(Where TR1, TR2 represents data transceiver)

To ensure correct transmission between 'User device 1' and 'User device 2', the data transmission among interface A, B and C must be correct.

A: Serial communication port, it may be RS232. To ensure data to pass through port A successfully, the configuration of interface data rate and format （8N1，8O1，8E1）of 'User device 1' should be the same as TR1

B: RF link. To ensure data to pass through B successfully, the configuration such as RF data rate and channel of TR1 should be matched to TR2.

C: Serial communication port is RS232. To ensure data to pass through port C successfully, the configuration of interface data rate and format （8N1，8O1，8E1）of 'User device 2' should be the same as TR2.

3.2 Different TX/RX Frequency

DTM-25 radio can operate in different TX/RX frequency. It has two channel mode named normal mode and exchange mode respectively. User can set the radio in normal mode or exchange mode by supervisory PC software. In normal mode, DTM-25 radio transmits on TX channel and receives on RX channel; but while in exchange mode, it will transmit on RX channel and receive on TX channel. As shown in Fig.3.1, If TR1 and TR2 are both in normal mode, TX frequency of TR1 is different from RX frequency of TR2, so they cannot communicate directly. In order to ensure two data radios communicate properly, one data radio should work in normal mode and the other should work in exchange mode.

3.3 Bandwidth configuration

TX signal bandwidth can be configured by supervisory PC software as 12.5 KHz and 25 KHz, the corresponding, if bandwidth of the receiver is configured as 12.5 KHz and 25 KHz. When the signal bandwidth is 12.5 KHz, the maximum RF data rate is 9600bps. And when IF bandwidth is 25 KHz, the maximum RF data rate is 19200bps. User can set RF data rate and bandwidth by supervisory PC software based on his application.

3.4 DTM-25 transmission parameters.

1) The switch delay from RX to TX: TC＜1ms, the timing diagram shown below:
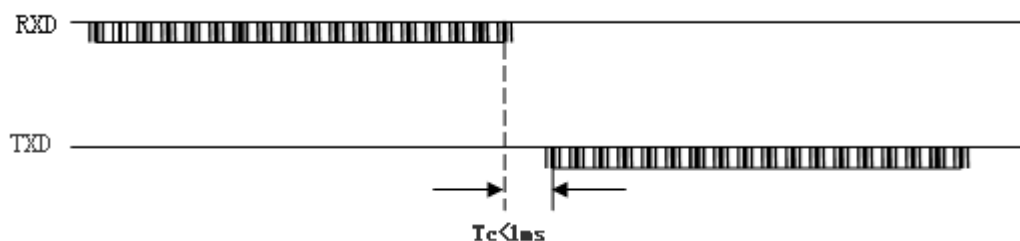

Fig 3.3 Switch delay from RX to TX schematic

2) Data transmission delay: The time of sending a byte from TXD of transmitter to RXD of receiver. The data transmission delay is different for different data rate. The difference is shown as below table:

Table 1: Data transmission delay VS data rate

RF Data Rate	Port Data Rate	Data Delay　(TS)
1200bps	1200bps	160ms
2400bps	2400bps	85ms
4800bps	4800bps	48ms
9600bps	9600bps	30ms
19200bps	19200bps	22ms

Timing diagram:

DTM-25
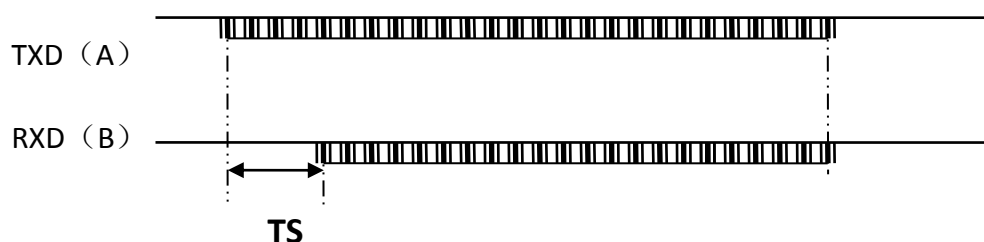
3) RX sensitivity and its corresponding RF data rate shown as below:

Table 2: RX sensitivity and its corresponding RF data rate

RF data rate	1200bps	2400bps	4800bps	9600bps	19200bps
RX sensitivity	-121dBm	-119dBm	-116dBm	-115dBm	-113dBm

4 Technical specifications

Table 3: Technical specifications

No.	Item	Technical Specification	Remark
1	Work Frequency	220MHz -222MHz	
2	RF output power	30W+/-2W	
3	Modulation	4GFSK	
4	Channel spacing	12.5Khz, 15KHz, 25KHz optional	
5	RX Sensitivity	Better than -121dBm（1200bps）	
6	Transmit current	≤6.5A（30W）	
7	Receive current	≤100mA	
8	Standby current	≤80mA	
9	RF data rate	1200/2400/4800/9600/19200bps	Set by user
10	Port data rate	9600/19200/38400/57600/115200bps	Set by user
11	Port data format	8E1/8N1/8O1	Set by user
12	Power supply	+10.5V - +15.0V, Typical +13.8V	DC
13	Adjacent channel power rejection	≤-60 dB	
14	Spurious Emission	≤-65 dB	
15	Frequency error	+/- 500Hz	
16	Operating Temperature	-30℃～85℃	
17	Humidity	10%～90% RH,	
18	Dimension	160×115×45 mm	
19	Weight	1000g	
20	Antenna Base	LS16-KF connector, female	

5 Data protocol
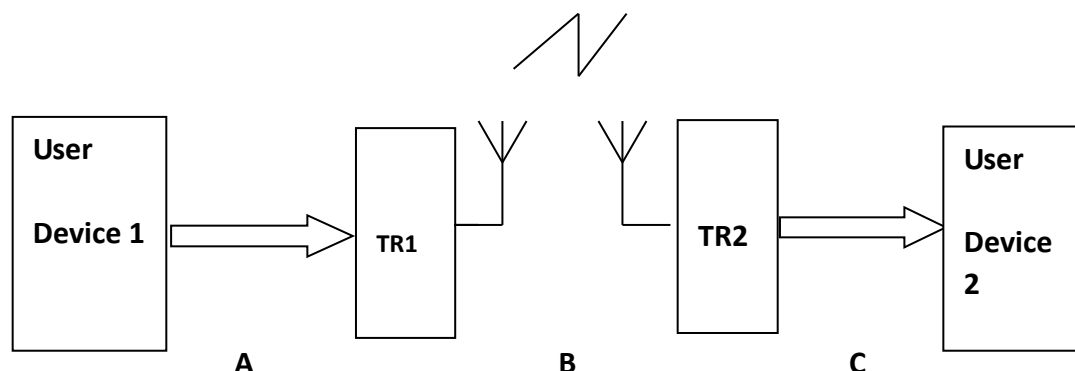
Fig. 5.1:   Application Schematic

Refer to Fig.5.1, the data package format from 'User Device 1' to data radio 'TR1'is shown in table 7-1. 'TR1'only recognizes the specific format, if the format is not correct, the data frame will be ignored (not be sent) or occurs transmission error. The field of data length indicates number of bytes between STX and ETX.

Table 5-1：The data package format to the radio 'TR1'

STX	data length	data	ETX
1byte	2bytes	N bytes	1byte
02H	……	……	03H

'TR1' handles the data package from 'User Device 1' based on the below rules:

1. If it starts with 0x55 AA, and the command analysis is passed, then it will be handled as serial port command. (Refer to the detailed description of 'DTM-25CA serial port protocol').
2. If it's not satisfied with item 1 and not starts with STX (0x02), it discards the first byte until it detects STX.
3. There must be 2 bytes of data length following STX. The higher byte is in front followed the lower byte.   The value of data length should be less than 2000, or the data package is discarded.
4. Data field follows data length field which indicates number of all bytes between STX and ETX.
5. 0x00-0x0F is allowed in Data field.
6. There must be ETX (0x03) followed data field. If no ETX found, the data package will be forced to end by adding ETX.
7. After 'TR1' receives the legal data package, data length should add 4.
8. CRC32 will be calculated for all the bytes between STX and ETX. CRC32 will be filled between data field and ETX as below table 7-2 shown. (Refer to the detailed description of   CRC32 algorithm)

Table 5-2：Data format after handling by TR1.

STX	data length	data	CRC32	ETX
1byte	2byte	N byte	4byte	1byte
02H	The initial data length+4	……	……	03H

9． Data package over 128 bytes will be divided into sub-packages. They are transmitted at the same time to be received to reduce data transmission delay.

Table 5-3:   The output 'TR2' output data package format

STX	data length	data	CRC32	ETX	RSSI
1byte	2byte	N byte	4byte	1byte	1byte
02H	The initial data length +4	……	……	03H	……

'TR2' handles the data package from 'TR1' based on the below rules:

1． If the first byte of the data package is STX (0x02), data length is correct and is not more than 2004, then 'TR2' continues to receive the data. Otherwise, it stops receiving data package and discard the data.

2. If the data package receiving is complete with correct CRC32, 'TR2' will upload the full data package. The format is as shown table 5-3.

3. If the data package receiving is complete with wrong CRC32, CRC32 will be replaced with 0xFF and CRC32 error LED will light for 2 seconds (PL).

4. If the data package is incomplete and no data package comes after 500mS, the data package will be filled with 0xFF to get a complete data frame. CRC32 will be filled with 0xFF. CRC error LED will light for 2 seconds (PL).

5． The format of data package to be uploaded by 'TR2' must comply to the format of table 5-3.

6． A byte of RSSI after ETX will be added to indicate the strength of received signal in the air.

6 Factory default setting and Accessories

Factory default setting   Accessories

Channel	CH01
Channel mode	Normal
Channel spacing	15kHz
RF power	30W
RF data rate	9600bps
Port data rate	115200bps
Check	8N1

Item	Quantity	Remark
Manual	1	Standard
RS-232 cable	1	Optional
CD	1	Optional
Antenna	1	Optional